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TROPICAL DISEASES BUREAU.

TROPICAL VETERINARY BULLETIN.

VOL. 5.] 1917. [No. 1.

DISEASES DUE TO PROTOZOAN PARASITES.

(a) AMOEBIASIS.

MACFIE (J. W. Scott). **A Case of Amoebic Dysentery in a Monkey.**—*Report of the Accra Laboratory for the Year 1915.* pp. 74–75. With 1 coloured plate comprising 4 figs. 1916. London, W: J. & A. Churchill.

A case of amoebic dysentery is described in a small monkey, *Cercopithecus petaurista*, used for inoculation with a strain of human trypanosome at the Accra Laboratory, West Africa; it died unexpectedly on the 65th day after inoculation, having shown symptoms of diarrhoea for some time, but appearing otherwise healthy.

On post-mortem examination the mucous membrane of large intestine was found to be congested and studded all over with ulcers which were most numerous near the caecum. Each ulcer was roughly circular with a central slough and raised, ragged, blood-stained edges.

In fresh preparations of the contents of the large intestine numerous amoebae were seen. When stained these measured from 12 to 30μ in diameter; the cytoplasm was much vacuolated and contained numerous bacteria-like chromidia. The nucleus was somewhat indistinctly stained by Leishman's method and appeared to possess a fine chromatin network but no distinct karyosome. In sections large numbers of the amoebae were seen in the bases of the ulcers and penetrating into the adjacent layers of the intestine.

Numerous cysts were also present, measuring, as a rule, 12 to 18μ in diameter, but some larger forms were seen which measured as much as 33μ; these possessed a thick wall, which stained red with Leishman's stain, and a single large vacuole occupying the greater part of the interior; the number of nuclei varied greatly—in some cysts there was only one, but in others there were several. These cysts somewhat resembled the bodies described by ALEXEIEFF (1911) under the name *Blastocystis enterocola.*

The name *Entamoeba cercopitheci* is suggested for the parasite.

Vast numbers of minute spirochaetes averaging 5·28μ in length were also found in smears from the large intestine; these resembled *Spirochaeta eurygyrata* found in human faeces and there was no evidence that they were pathogenic in this case.

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EICHHORN (A.) & GALLAGHER (B.). **Spontaneous Amebic Dysentery in Monkeys.**—*Jl. Infect. Dis.* 1916. Sept. Vol. 19. No. 3. pp. 395–407. With 6 figs.

The outbreak here described occurred in a batch of 15 spider monkeys (*Ateles ater*) kept at the National Zoological Park, Washington, U.S.A., and imported between July and December 1915 from Colombia and Salvador. The monkeys ranged in age from 2 to 5 years and were placed together in a large exhibition cage. One of the monkeys, received on October 26th, showed symptoms of illness on arrival, similar to those manifested later by the others, and it appears probable that this monkey introduced the infection. Eight animals out of the total of 15 exposed succumbed, and of nine showing symptoms only one recovered. While in captivity it was noticed that these spider monkeys had developed a depraved appetite for the faeces which they evacuated. A minute history of the disease in each animal is given.

The symptoms shown were briefly as follows :—Marked dejection, temperature remained practically normal, and appetite, while diminished, was fairly good up to the time of death ; loss of weight, but emaciation not marked. The principal symptom was severe diarrhoea, the faeces being usually of a fluid consistency, yellowish grey in colour, and foetid, containing at times a considerable amount of mucus with yellowish flakes ; in the more acute cases the faeces were sometimes blood-stained. In several cases the symptoms were apparent for only two or three days before death, while in other cases they lasted for a period of from two to four weeks, the animal at times appearing to have somewhat recovered, and then it would relapse and die suddenly.

On post-mortem examination the caecum and colon were found affected in all eight cases, the rectum being involved to a greater or less degree. No visible lesions could be found in other portions of the gastro-intestinal tract. Abscesses were found in the liver in two cases. The lymphatic glands in the neighbourhood of the colon were sometimes found to be enlarged and oedematous.

The lesions in the large intestine were pronounced and took the form of a dense corrugation and necrosis of the mucous membrane, which in advanced cases was affected nearly throughout. In milder cases the lesions took the form of numerous small ulcers from 1 mm. to 1 cm. in diameter, well separated from each other, and presenting raised, congested, irregular borders. The affected portions of the intestine which had not become ulcerated were covered with a thick, amorphous, diphtheritic material. The deep ulcers penetrated beyond the submucosa, but no indication of the condition in the lumen of the intestine was apparent from the peritoneal surface.

Abscesses of the liver were found in the two cases showing most extensive intestinal lesions ; in one case, only one abscess was present, while in the other case five fairly large abscesses and two smaller ones were observed.

A detailed account is given of the lesions involving the intestines and the liver in each animal.

No special attempt was made to determine the species of the amoebae. The amoeboid forms were especially numerous in the liver abscesses, but could also be readily found in intestinal matter, the encysted forms being more numerous in the latter. In the vegetative stage they showed very active protoplasmic changes when taken fresh from the pus of liver abscesses or from faecal material.

To determine the relationship of the causal organism of this disease, named *Amoeba ateles* by the authors, to the tropical dysentery of man an attempt was made to transmit the disease to cats, since these animals are susceptible to *Amoeba histolytica*. Feeding experiments on four cats gave negative results, suggesting that the parasite belonged to a different species from that of man. It is stated, however, that the results do not warrant any conclusions as to the pathogenicity of this parasite in cats, since failure of transmission to a limited number of animals is not sufficient evidence as various investigators have found that the transmission of human amoebic dysentery to cats is not invariably successful.

(b) ANAPLASMOSIS.

FINZI (G.) & CAMPUS (A.). **Anaplasmosi. Sul significato dei " Corpi Endoglobulari " " Punti Marginali " " Anaplasmi ", trovati nel sangue degli ovini della Sardegna e del Piemonte.** [Anaplasmosis. The Significance of " Intra-corpuscular Bodies." " Marginal Points," "Anaplasms " found in the Blood of Sheep from Sardinia and Piedmont.]—*Nuovo Ercolani.*, 1916. Oct. 31–Nov. 10, Dec. 10–20, and 1917 Jan. 15–31. Vols. 21 & 22. Nos. 30–31, 34–35, and 1–2 respectively. pp. 493–500, 557–571, and 2–8 respectively.

The greater part of this article is concerned with an exhaustive survey of the literature dealing with the subject of anaplasms since they were first incriminated by THEILER in 1908 as the cause of the so-called " gall-sickness " of cattle in South Africa. Various authors have since found these bodies in the blood of cattle suffering from diseases clinically resembling gall-sickness in widely separated parts of the world.

A description of the morphology and incidence of anaplasms in the blood is given. Numerous observers have recently discovered similar structures in the blood of other species of animals, particularly in animals suffering from diseases characterised by grave anaemia; considerable doubt has thus been shed on the specificity of anaplasms, many observers holding that they are merely artefacts, forms of degeneration accompanying anaemia, or remains of other blood parasites. The views of authors who have attempted to disprove the parasitic nature of the structures are very fully entered into.

The observations made by Finzi and Campus were limited to a few sheep imported for experimental purposes from Sardinia.

> " Tibaldi (1914), considering that in Sardinia—on account of its geographical position, frequent inter-communication with the coast of Africa, and the great abundance of Ixodidae and other arthropods—haemoparasitic protozoa could not be lacking examined numerous smears prepared from the blood of various Sardinian animals, and he found, in fact, after methodical researches, forms of anaplasms in the dog, pig, horse, sheep, and guinea-pig."

One of the imported sheep kept under the authors' observation, after a few months, developed acute symptoms of liver-fluke disease. On examination of blood smears a large number of red blood corpuscles were found to contain in the centre, but more frequently at the periphery, coccus-shaped bodies, which took on an intense chromatin tint, and were considered to be absolutely identical with the protozoan structures named by authors "marginal points" or "anaplasms."

On examining the blood of the remaining six sheep it was found that in the case of two of them the red blood corpuscles were invaded with similar bodies to the extent of 30 per cent. These two sheep showed manifestations of anaemia and the eggs of the liver fluke were found in their faeces. The sheep showing these structures were obviously suffering from fluke disease.

Examination of blood from sheep in two districts in Italy was then undertaken and in some of these sheep bodies similar to anaplasms were discovered, but it had to be admitted that these sheep were also suffering from fluke disease.

The authors endeavoured to elucidate the problem as to the nature of these structures by provoking experimental anaemia in sheep and rabbits. Some of the rabbits were deprived of their spleens as one of the authors (Finzi) had previously demonstrated the destructive power of the spleen on haemoglobin. Some of the animals were inoculated with a large quantity of distilled water and others with a specific anti-red-corpuscle serum. Smears were made from the blood at varying intervals.

The usual anaemia changes in the red blood corpuscles were seen and a large number of the corpuscles were alleged to contain bodies similar to marginal points.

The authors' conclusions are as follows :—

"(1) The observations made by Tibaldi in Sardinia and our own observations do not allow of our affirming the existence of anaplasmosis in Sardinian sheep.

"(2) It is easily proved that 'marginal and central points' can be found also in the red blood corpuscles of Piedmontese sheep.

"(3) The marginal and central structures are not always the real and true parasites.

"(4) The intracorpuscular marginal and central bodies are frequently signs of changes of the blood commonly observed in the anaemic state.

"(5) Acute secondary anaemia following grave distomatiasis gives rise, in the sheep, to the possible appearance within the red blood corpuscles of certain round corpuscles, coccus-shaped, 0·1 to 0·5 microns in diameter, placed either at the periphery or centre of the corpuscle.

"(6) The anaemia following the injection of specific haemolytic sera into sheep also produced changes in the corpuscles represented by the appearance of dots and of central and peripheral granules.

"(7) The anaemia following the injection of distilled water shows, in normal rabbits and in rabbits deprived of their spleens, changes in the blood exactly comparable to those observed in sheep affected with anaemia produced experimentally by specific haemolytic serum.

"(8) The results of our experiments fully confirm the conclusions arrived at by Dias and Aragao and by Laveran and Franchini.

"(9) Although convinced that not all the forms of disease described as anaplasmosis are real and true diseases due to a specific protozoan, and that the 'intracorpuscular bodies' or 'marginal points' may have much less significance than some authors have thought fit to attribute to them, nevertheless the observations of Theiler and Lignières — and more especially those of the latter author—require that anaplasmosis should be considered amongst the protozoan diseases due to parasites of a special type which should be considered as a separate and distinct on its own account and as a clearly defined morbid entity."

[The object of these authors' experiments cannot be understood as the anaemia provoked by their methods would naturally have been expected to give rise to the well-known changes in the corpuscles known as punctate degeneration. Moreover, the authors do not seem to have taken into account the clinical nature of the disease, the descriptions of the South African gall-sickness not corresponding in any way with the disease described in their sheep.

As regards the confusion between gall-sickness or anaplasmosis and ordinary redwater it appears that these diseases can be easily distinguished experimentally, for when blood containing the causal organisms of both diseases is inoculated into a susceptible animal the reaction set up by the one disease takes place much later than in the case of the other.—Ed.]

(c) Coccidiosis.

Guillebeau (A.). **Parasitisches Vorkommen von** ***Eimeria Stiedae*** **(Lindemann) in der Leber des Hundes.**—[*Eimeria stiedae* Lindemann in the Dog's Liver.]—*Schweiz. Arch. Tierheilk.* 1916. Nov. Vol. 58. No. 11. pp. 596–602. With 6 text figs.

Coccidiosis of the liver, although common in rabbits, is very rarely found in the pig (Johne), and in the dog (Rivolta, Perroncito). Bornhauser (1912) described the occurrence of coccidia in the epithelium lining the bile duct and in the liver parenchyma of the dog; these parasites were much larger than those found by the author, and belonged to the so-called *Diplospora* (or *Isospora*) *bigemina*.

The two cases described by the author occurred in old dogs (10 and 13 years old, respectively,) in which the most marked symptom during life was great enlargement of the abdominal cavity.

On post-mortem examination this was found to be caused by the presence of a large quantity of blood-stained exudate. The spleens were enlarged. The liver was also increased in size and distorted in appearance. In one case numerous soft dark red centres ½ to 1 cm. in diameter could be seen on the surface of the liver and in both cases these were found to be numerous in the parenchyma.

Microscopic examination of scrapings from these nodules showed the presence of red blood corpuscles among which were found a large number of small parasites, uniform in shape, measuring 7 by 12μ, containing a nucleus 3μ in diameter. This nucleus underwent changes after exposure to the air for a day. These parasites are smaller than those found in rabbit coccidiosis, in which the parasites, as a rule, measure from 20 to 50μ in length by 20–39μ broad.

Histology.—The less advanced lesions were found to be composed of a network formed of trabeculae of liver cells and filled with red blood corpuscles. The liver cells were nucleated and contained a granular protoplasm in which were found rounded lightly-staining parasites 1μ in diameter containing a small point which stained deeply with haematoxylin. These parasites were considered to be the schizonts of coccidia.

In the more advanced lesions distension of the blood vessels becomes more and more marked while the liver trabeculae become shrunk down to 20 or even 4μ in thickness, and covered at a distance of 4μ on either side by a membrane about 2μ in thickness corresponding to the walls of the intralobular capillaries. The trabeculae finally disappear completely until in places the section is composed almost entirely of red blood corpuscles, among which are found numerous coccidian zygotes.

(d) BIRD MALARIA.

BRUG (S. L.). **Morphologische Studien an** *Proteosoma praecox.* [Morphological Studies on *Proteosoma praecox.*]—*Arch. f. Schiffs- u. Trop.-Hyg.* 1916. July. Vol. 20. No. 13. pp. 289–306. With 2 coloured plates, comprising 104 figs.

These studies were undertaken with the object of determining whether certain forms could be seen which had caused HARTMANN to classify Proteosoma among the Binucleata.

The material was obtained from the blood of canaries infected with Proteosoma. The best preparations were obtained after drying and fixing with alcohol, and staining with Giemsa for three to four hours. Good results were also obtained by using Kiewiet de Jonges stain consisting of Azur II 40 mg., eosin 25 mg., methyl alcohol 25 cc. This stain was placed on the unfixed smear, an equal quantity of distilled water added immediately, and then allowed to stand for from one-half to one hour. Other methods of fixation and staining are also described, but the results obtained were not good.

The various stages in the life-cycle of the parasite are very well depicted in the coloured plates.

In order to study the development of the microgametes the slide covered with the fresh blood film was placed for from 10 to 75 minutes in a moist chamber consisting of a Petri dish containing some moist blotting paper, and then dried and stained with Giemsa. Better preparations are obtained in this way than when blood is taken from the stomach of flies, as in the latter case it soon coagulates and poor smears can only be obtained. The author dwells at some length on the analogy which some authors have thought to exist between the microgametes and the trypanosomes.

The conclusions are as follows:—

"(1) In the life-cycle of Proteosoma there occurs a stage in which these organisms appear bi-nucleated, recalling somewhat the same characters of certain flagellates. In young schizonts there is often seen an accessory nucleus which divides by amitotic division.

"(2) The half or fully grown schizonts, the sexual forms, the ookinetes, show no accessory nucleus (blepharoblasts).

"(3) Although the bi-nucleated character of the young schizonts can be brought forward in order to indicate the resemblance between the Proteosoma and Trypanosomidae the differences between them are too great to enable one to classify them in the same order. (It is always questionable whether there exists a sexual stage in the Trypanosomidae, etc.).

"(4) The gametes in the peripheral blood in cases of experimental infection of canaries with Proteosoma by means of blood inoculation often appear at the same time as the schizonts. Their appearance is not consequent upon commencing immunisation.

"(5) The microgametes are built out of a chromatin net found towards the periphery of the microgametocytes. Certain forms can be found among these which can be mistaken more or less easily for the structure of a trypanosome.

"(6) Reduction bodies are extruded in the process of maturation of the macrogametocytes."

(e) SPIROCHAETOSIS.

BEKENSKY (P.). **Contribution à l'étude des spirochètes des voies digestives des porcs dans leurs rapports avec la peste porcine.** [The Relation between the Intestinal Spirochaetes of Pigs and Swine Fever.]—*Rec. Méd. Vét.* 1916. Oct. 15. Vol. 92. No. 19. pp. 545–552.

In this preliminary communication from the veterinary laboratory of the Ministry of the Interior at Petrograd, the author first brings under review the works of various investigators who have of late years discovered spirochaetes in the blood, intestines, and cutaneous lesions of pigs affected with swine fever. Reference is made to the publications of SMITH (1894), SIEGEL, DODD, POENARU (1906), CLELAND, GILRUTH, and RUTHER.

The works of the American authors, KING, HOFFMAN, DRAKE, and BASLACK are also reviewed at some length. These authors, in a series of articles, claim to have discovered short rare spirochaetes in the blood of swine fever affected pigs, and also somewhat longer ones in scrapings from intestinal ulcers, the mucus covering the caecal ulcers, and towards the ileo-caecal valve, as well as in the external lesions of affected pigs. These organisms could not be discovered in the other organs and tissues. In recovered pigs the spirochaetes were observed to disappear. These investigators thus concluded that in the mucus covering the caecum of healthy pigs there exist a number of large non-pathogenic spirochaetes; in the ulcers of the caecum and along the ileo-caecal valve of swine fever affected pigs one nearly always finds spirochaetes of a special kind which play a part in the evolution of swine fever. They are further of opinion that the morphological differences between the spirochaetes found in the blood and in the ulcers and local lesions of affected pigs might arise on account of the influence of the blood as a medium on the spirochaetes, or on account of the natural evolution of the organisms.

ARNHEIM, critisising the conclusions of the preceding authors found that salvarsan, which is toxic for spirochaetes, has no influence on swine fever, and also he was able to find spirochaetes in the blood of affected pigs only on one occasion.

Bekensky thus, from a study of the literature, concludes that there is no agreement on the question of the relationship between the intestinal spirochaetes and swine fever.

The question was studied by him on the carcases of pigs sent to the laboratory for diagnosis, the caeca and recta of healthy pigs collected at the Municipal Abbatoir at Petrograd, live healthy pigs hyperimmunised against swine fever, pigs among which outbreaks of swine fever had occurred, and, finally, pigs among which anthrax had broken out. A very thorough examination for the presence of spirochaetes was made on these animals.

After a considerable number of failures mixed cultures of spirochaetes were obtained for use in experiments on sucking pigs.

Detailed measurements of the spirochaetes, including length, number of spirals, length and amplitude of the spirals, were also taken.

The author concludes as follows:—

"In the examination of pigs affected with swine fever, spirochaetes were discovered in a large number of cases, but not always (58·7 per cent.).

It was brought out that spirochaetes could be found in the case of pigs living in establishments where swine fever existed (17 per cent.), and on the contrary when pigs were affected with swine erysipelas or with anthrax spirochaetes were not once found.

"In the case of sucking pigs artificially infected with the ultra-visible virus, spirochaetes were discovered in nearly all cases (17 out of 19).

"In the case of pigs inoculated and drenched with mixed cultures of spirochaetes and in pigs placed in contact with these animals spirochaetes were discovered in all cases (7), but one must bear in mind that at the same time in these experiments the typical picture of swine fever was not obtainable. *These facts seem to point out that in pigs suffering from swine fever the spirochaetes found in the intestinal tract play a certain etiological role, in the same manner as the other micro-organisms which provoke a secondary infection, the fundamental disease being due to the ultra-visible virus.* Moreover, in the case of hyper-immunised pigs in the bodies of which one would suspect the presence of swine fever antibodies spirochaetes were not discovered on any occasion. The fact that spirochaetes have been found in healthy pigs in establishments perfectly free from swine fever does not contradict this statement; the experiments of UHLENHUTH, GABBERT, and others on *B. suipestifer*, and the experiments of SMITH, MOORE, BANG, JENSEN, KARLINSKI, KITT, KLEIN, and others on *B. suisepticus*, show that agents of secondary infection are encountered in the bodies of healthy animals. The frequency of spirochaetes in healthy pigs varies from 7 to 12 per cent.

"*On one hand*, it is admissible that on account of the lowered resistance of the body and the influence of the ultra-visible virus the spirochaetes of the digestive tract, like other saprophytes present in the bodies of pigs and harmless for a certain time, acquire a greater power of reproduction and perhaps of pathogenicity on the pig's body in general, and especially in the direction of producing morbid lesions in the digestive tract.

"*The other side* of the question is by no means clear. Are the spirochaetes found in the digestive tract of pigs capable of producing a general infection or only a local action? Moreover, the work of observers who have found spirochaetes in the blood and cutaneous lesions of affected pigs does not exclude the probability that the spirochaetes found in the digestive tract of pigs are capable of passing into the blood by way of the lymphatics, and are thus the determining agents of swine fever. The fact that spirochaetes have not been discovered by us in the blood gives no reason for denying categorically the probability of this supposition, but it might indicate that the spirochaetes found in the blood are at a stage of their development in which their discovery would be very difficult.

"In conclusion, it is necessary to note that the spirochaetes found by us in the digestive tract of pigs, viz., spirochaetes with large and spirochaetes with small spiral wave lengths were found together in every part of the digestive tract—in the case of healthy animals, as well as in pigs affected with swine fever."

(f) TRYPANOSOMIASES.

LAVERAN (A.). **Surra, nagana ferox, nagana de l'Ouganda et infections due au** ***Trypanosoma rhodesiense.*** [Surra, Nagana Ferox, Uganda Nagana, and Infections due to *T. rhodesiense*.]—*Bull. Soc. Path. Exot.* 1916. Nov. Vol. 9. No. 9. pp. 731–738.

Differences of opinion have arisen among authors as to the relations existing between *T. brucei* and *T. rhodesiense*, and as to the unicity or plurality of the trypanosomiases described under the name of nagana. BRUCE and his collaborators, as the result of their researches, based principally on measurements, concluded that the above two trypanosomes were identical. The author in 1912 published the results of some cross-immunity tests which demonstrated that they were not identical. The biometrical method has been shown by DUKE, SCHILLING, and SCHRECK to be liable to give rise to errors.

It appears that animal trypanosomiases of different natures have been confounded under the name of nagana. The work of STEPHENS and BLACKLOCK shows that the parasite of Zululand nagana is a monomorphic trypanosome, whilst that of Uganda nagana is of the dimorphic type, and thus these trypanosomes cannot be identical. The name *T. ugandae* was given by them to the latter trypanosome. MESNIL'S cross-immunity tests also showed that these two types were different. Authors are agreed that Zululand nagana is quite distinct from surra. The identity of Zululand nagana and Uganda nagana being disputed, the author thought it would be interesting to find out whether goats immunised against Mauritius surra remained susceptible to Uganda nagana.

Five goats and one sheep were used in his experiments and the following viruses were employed: the Mauritius surra virus kept in the author's laboratory; the virus of nagana ferox from EHRLICH'S laboratory, maintained for several years in the author's laboratory; the virus of Uganda nagana obtained from BRUCE and kept in the author's or in MESNIL'S laboratory; and *T. rhodesiense* from the Runcorn Research Laboratory, Liverpool, kept for five years in the author's laboratory. A detailed account of each animal during the course of these experiments is given. The following is a résumé of the observations:—

Goat 1.—A clean goat, inoculated with Uganda virus, became infected, and died at the end of 66 days.

Goats 2 *&* 3.—These goats, immunised against surra, were inoculated with the Uganda virus, became infected and died, the first in 96 days, the second in 52 days.

In these three animals the infection produced by the Uganda virus was characterised by fever, wasting, and nervous symptoms during the last phase of the disease, consisting in paresis of the hind quarters, trembling, ataxic movements and convulsions; in the three cases the disease was fatal.

Goat 4.—Inoculated on the 10th September 1914 with Uganda nagana, became infected, and in the month of June 1915 it had acquired immunity against this trypanosomiasis. Inoculated on the 14th September 1915 with *T. rhodesiense* it became infected; in the month of June 1916 it had recovered and possessed immunity against this trypanosome; after inoculation on the 23rd August 1916 with the virus of nagana ferox it did not become infected.

Goat 5.—Inoculated with nagana ferox on the 6th April 1915, became infected, and in the month of September 1915 it was immune against this trypanosomiasis. After inoculation on the 22nd January 1916 with the virus of Uganda nagana on two separate occasions the goat did not become infected. After inoculation on the 16th August 1916 with *T. rhodesiense* it became infected.

The *sheep*, which had acquired, in August 1914, a strong immunity against nagana ferox, and was inoculated on the 13th November 1914 with the virus of Uganda nagana, became infected and died.

The following conclusions are drawn from these results:—

"(1) Goats 2 and 3, immune against Mauritius surra became infected with the virus of Uganda nagana in the same manner as the clean goat 1, and the disease presented the same degree of severity in the case of all three animals; Uganda nagana thus has no relationship with surra.

"Goat 4 immune against Uganda nagana, and Goat 5 immune against nagana ferox and Uganda nagana, when later inoculated with *T. rhodesiense* became infected; it thus results that the viruses of nagana ferox and Uganda nagana have no connection with *T. rhodesiense.*

"Goat 4, having acquired immunity against Uganda nagana and *T. rhodesiense,* did not become infected after inoculation with nagana ferox; the same applied to Goat 5, immune against nagana ferox and, inoculated twice with the virus of Uganda nagana, did not become infected; but, the sheep immune against nagana ferox was shown to be as susceptible as a clean animal to Uganda nagana.

"These last facts, which seem contradictory, can be explained if one admits that Uganda nagana and nagana ferox are varieties of the same species, one of the varieties having been able to acquire a higher degree of virulence than the other. I have not observed between the trypanosome of nagana ferox and that of Uganda morphological differences pronounced enough to exclude this hypothesis."

MESNIL, in discussing this paper, notes that in Laveran's experiments the sheep immune against nagana ferox, which seems to be only a laboratory variety of Zululand nagana, was as susceptible as a control animal to Uganda nagana. He also believes, however, in the specific identity of the viruses on account of the results obtained from the cross-immunity tests on goats.

Another point raised was that nagana ferox, or the laboratory Zululand nagana, consists of monomorphic trypanosomes. However, the Uganda nagana virus as seen by BRUCE and his collaborators in the country it originated from—like that of Zululand nagana when introduced into Europe in 1896—was polymorphic, and was still so when STEPHENS and BLACKLOCK studied it and sent it to him (MESNIL) in 1911, but in 1913 he already noted that it was in the process of losing its short and stumpy forms. Laveran now notes that it scarcely differs morphologically from nagana ferox. The nagana virus as well as *T. gambiense* and doubtlessly other viruses of the same group, from being naturally polymorphic, become monomorphic in laboratories.

VAN SACEGHEM stated that in the Belgian Congo the *brucei* virus obtained from Zululand was polymorphic and that its polymorphism was maintained in equines, bovines, goats, sheep, rabbits, and guinea-pigs. On the other hand, in the white rat he only obtained intermediate forms of the trypanosome.

MITZMAIN (M. B.). **Collected Studies on the Insect Transmission of** *Trypanosoma Evansi.—Treasury Department. United States Public Health Service. Hygienic Laboratory Bulletin* No. 94. 1914. June. pp. 7–39. With 5 plates comprising 10 figs. Washington: Government Printing Office.

In these studies the author undertook to ascertain the possible rôle in the transmission of surra of all the common flies found on horses and other susceptible animals in the Philippine Islands.

(1) *The Relation of* Tabanus striatus *to Surra Dissemination.*

An interesting account of the literature dealing with the association of the Tabanidae with animal trypanosome transmission is given. Reference is thus made to the work of ROGERS (1901) with surra in India, FRASER and SYMONDS (1908) with surra in the Federated Malay States, Ed. and Et. SERGENT (1905–1906) with the trypanosomiases encountered in Algeria, BRUCE and his collaborators (1910) with African cattle trypanosomiasis (*Trypanosoma pecorum*), LEESE (1911–1912) and BALDREY (1911) with surra in India, and MOHLER and THOMPSON (1909) with surra in imported Indian cattle.

In a previous series of experiments the author endeavoured to determine to what extent *Tabanus striatus* Fabricius, the common house (horse ?) fly of the Philippines, was involved as a mechanical carrier of trypanosomes. It was noted that in these experiments a very small percentage of positive results (3 out of 16 attempts) was obtained; it was concluded that the feeding methods employed restricted the normal behaviour of the flies, for, after the single insertion of the proboscis into the infected animal, the flies were noticed to complete their meal upon the healthy host. In nature the feeding is differently conducted as it was observed that owing to the irritability of the host a fly always required several insertions of its proboscis at short intervals into different hosts.

Two experiments in which the more natural behaviour of the gadfly was simulated resulted successfully, both animals, a horse and a bull, showing undisputable evidence of the disease.

In previous experiments trials with single flies resulted negatively when the fly was permitted to bite infected and healthy animals once only. An experiment was carried out in which a tabanid was induced to feed with the maximum number of interruptions, on two hosts alternately, with only a few seconds interval between the bites. The infected and healthy horse were thus each bitten 26 times. The healthy horse after an incubation period of 9 days presented symptoms and died 67 days later. The experiment was also successful when repeated on monkeys.

The length of time *Tabanus striatus* remains infective was determined by feeding a number of flies on an infected animal and transferring them on to susceptible animals at intervals varying from three minutes up to between three and four hours. It was found that 15 minutes is the maximum time during which the fly is able to infect through its biting.

In order to test the indirect method of infection, the author succeeded in keeping a limited number of flies alive under artificial conditions for 26 days in the case of two experiments and 21 days in the case of one experiment. After the initial engorgement on a surra-infected horse the flies were applied at intervals varying from one to two days up to 24–26 days upon susceptible horses. The results were entirely negative. The bodies of the dead flies, when inoculated into guinea-pigs and a horse during this period, did not produce surra.

The problem as to how many horses flies could infect successively was determined by exposing three horses, screened from each other, to the bites of flies which had contaminated their labia by biting a horse whose blood was swarming with trypanosomes. Forty-three flies thus fed on the sick horse, 43 on the first contact horse, 39 on the second contact horse, and 32 bites were completed on the third contact. After an incubation period of six days the first contact horse showed a rise of temperature together with trypanosomes in its blood and died on the 62nd day. The second and third contact horses remained healthy and no trypanosomes could be discovered in their blood either by microscopic examination or by inoculation into monkeys and guinea-pigs. This shows that the bite of *Tabanus striatus* is incapable of infecting more than one horse as the result of a previous contamination.

The author next describes an outbreak of surra on the Government stock farm near Manila which, from a study of the topography of the district and the conditions in which the animals were placed, pointed to *Tabanus striatus* as being the most probable carrier of infection. Stallions kept in darkened stables did not contract the disease ; daily examinations of their quarters showed an absence of gadflies, although the stable inhabiting species, *Hippobosca maculata* and *Stomoxys calcitrans*, in addition to several species of mosquitoes were encountered.

From an exhaustive study of the breeding places of the gadfly, *Tabanus striatus*, in Southern Luzon the author found that the distribution of the fly coincided exactly with the places where very serious outbreaks of surra occurred.

Many investigators have observed that Tabanidae do not infest animals kept in a darkened stable. The author refers to the observations of SCHAT (1903) in Java, LAVERAN and MESNIL (1907) on an outbreak of surra in cattle in Mauritius, and LEESE on the influence of dark stables in India in preventing the spread of surra.

An observation is recorded in which a horse infected with surra was allowed to remain in an open shed with eleven other horses and four bulls. Many stable flies and Hippoboscids were seen, but gadflies were not in evidence. None of the in-contact animals became infected.

The protection afforded by darkened stables was also shown during a trial in which three horses and two carabaos were placed in a partially darkened shed where three surra-infected carabaos in contiguous stalls were exposed to biting flies during the season of maximum tabanid infestation. The eight animals were not disturbed for a period of two months. Culicoides, Phlebotomus, and various species of mosquitoes were observed in addition to stable flies and Lyperosia. During the entire period two specimens only of *Tabanus striatus* were collected, although in the adjoining pastures they were extremely numerous. The five healthy animals remained uninfected as the result of the experiment.

(2) *The Relation of Mosquitoes to Surra.*

LEESE in particular among the authors quoted considered that he had satisfactorily eliminated Anopheles, Culex, and Stegomyia in several surra transmission experiments performed in India. In a large series of experiments with surra in the Philippines the author himself was not able to transmit the infection with several species of mosquitoes. Details of experiments are tabulated in which two species, viz., *Aedes* (*Stegomyia*) *calopus* and *Culex fatigans* are considered in relation to various hosts in the direct method of infection. Negative results only were obtained in all (seven) experiments.

In an experiment, the larvae were reared from the eggs of 300 specimens of the first of these two species of mosquitoes, fed previous to laying their eggs on an infected horse: these larvae were then applied to a healthy horse, with negative results; the matter of hereditary transmission was thus disposed of as well as transmission by the indirect method.

Mosquitoes were found to harbour surra trypanosomes for a greater length of time than any other blood-sucking insects. Several specimens of *Aedes* (*Stegomyia*) *calopus* were found to contain active trypanosomes in the proventriculus for a period of 42 hours after the infective bite. No trypanosomes were found in the salivary glands or in the mouth parts during various periods up to 36 days. Thirty hours was the longest period the trypanosomes were found to be virulent by inoculation.

The author next describes a field experiment in which healthy horses were exposed by night to infection by contact with infected horses. The exposed horses were removed during the day-time in order to eliminate *Tabanus striatus* as a transmitting agent. None of the exposed horses became infected.

(3) *Notes on the Bionomics of* Lyperosia exigua *and the Relation of this Fly to Experimental Trypanosomiasis.*

This fly is the most common of all the species of blood-sucking flies on draught animals in the Philippine Islands. It is prevalent during all seasons and during all hours and is usually at rest on bovines at night, accompanying mosquitoes and sandflies. It is rarely found on horses. A detailed account of the life-cycle, which lasts on an average 9–11 days, is given. The probability of this fly acting as a mechanical transmitter has been mentioned by SCHAT, LEESE, and AUSTEN. In experimenting with this fly three methods of procedure were adopted, viz. :—(1) Exposing healthy animals and infected animals to the bites of flies under natural conditions. Here counts were made of flies taken in the act of biting the hosts kept in the open ; (2) the experimental animals were exposed in a screened stable to the biting of a specified number of flies collected from known sources ; (3) bred flies were applied from test tubes upon infected and healthy animals at stated intervals. The author's own summary of the results of these experiments is as follows :—

"Experiments in the direct method with *Lyperosia exigua* and *Trypanosoma evansi* gave negative results.

"Horses, which were exposed under natural conditions to the biting of flies infesting sick carabaos, did not become infected.

"When thousands of flies infested sick and healthy carabaos placed in a large screened inclosure no infection was transferred.

"Only negative results were obtained in the interrupted method of feeding flies in 13 experiments with various animals. In six trials there was no appreciable interval between the bites of flies removed from the infected hosts, and in seven experiments intervals occurred varying from 5 hours to 10 days. The greatest number of flies employed was 61.

"In one experiment with several thousands of flies the possibility of transmission of *Tr. evansi* hereditarily was eliminated."

(4) *Mechanical Transmission Experiments with* Philaematomyia crassirostris.

This species of fly is as numerous as the ubiquitous stable fly especially during the months of April and May. It has previously been described in India and Africa and is noted for its peculiar mouth apparatus which, at first sight, would appear to belong to a non-blood-sucking form. It preferably infests cattle.

Experiments in the direct method of transmission proved unsuccessful at intervals of less than one minute, an hour, and 24 hours. One experiment only proved successful ; a monkey became infected as the result of six successive daily applications of numerous fresh flies which had just previously fed on an infected monkey.

(5) *Experiments with* Hippobosca maculata *in the Transmission of Surra.*

This fly is found upon all draught animals, especially on horses, during the whole year and it seems to attack equally well in darkened stables and in open pastures. As a rule it prefers to finish its protracted meal upon the same host. Twelve experiments in the direct method of feeding were pursued, using guinea-pigs for the most part; entirely negative results were obtained. A number of flies were next fed on an infected animal and applied to clean animals every day up to the 26th day, when there were only two survivors out of the original 33. Negative results again were obtained.

(6) *Experiments with Blood-sucking Gnats.*

Experiments with *Culicoides judicaudus*, in which some hundreds of flies were employed, both in direct and indirect transmission experiments, gave negative results.

Observations on a very common species of *Phlebotomus* likewise showed that this insect was incapable of transferring surra from infected to healthy animals.

(7) *The Role of* Musca domestica *in Surra Conveyance.*

The intimate relations existing between the feeding habits of *Stomoxys calcitrans* and the common house fly had been previously noted by the author. It was pointed out that the house fly acted in a sense as a secondary passive parasite by lapping to a point of engorgement the blood brought to the host's epidermis by the probing of the labium of the stable fly. It was first proved by means of numerous dissections and inoculation of saline suspensions of the abdominal contents into susceptible animals that *Musca domestica* could harbour infective organisms.

Attempts were made to simulate natural conditions by feeding large numbers of house flies on the blood of an infected animal and then allowing them to feed in conjunction with an equal number of clean Stomoxys on the tail of a clean monkey. The house flies then applied their mouth parts to the punctures made by the stable flies. Five experiments made after this manner gave negative results.

The possibility of surra infection being carried by the fly's feet was tested by repeating the preceding experiment, but in this case the flies were prevented from feeding and were only allowed to alight on the tail. Five experiments made in this way also failed to show that the wound made by the labium of the stable fly was a suitable channel for the introduction of trypanosomes.

It was further shown that the bites of the stable fly were not suitable sites for the introduction of trypanosomes by smearing fresh infective blood on a part that had just been bitten by Stomoxys.

House flies that had engorged on blood obtained from the bites of stable flies on infected animals were next allowed to feed on the abraded surface of the skin of three monkeys and two horses. It was found that positive results were obtained in four cases out of five.

Noeller (W.). Die Uebertragung des *Trypanosoma theileri*, Laveran, 1902. [The Transmission of *Trypanosoma theileri* Laveran, 1902.]—*Berlin. Tierärztl. Woch.* 1916. Sept. 28. Vol. 32. No. 39. pp. 457–460. [Reprinted from the *Rev. Applied Entom.* 1917. Jan. Vol. 5. Ser. B. No. 1. p. 11.]

"The innocuous and easily bred *Trypanosoma theileri* probably occurs wherever domestic cattle are found and also among wild ruminants, such as antelopes. Its various forms have received different names. Knuth and Rauchbaar found flagellates in German TABANIDAE (*Tabanus* sp.? and *Haematopota pluvialis*, L.), but could not prove their connection with this trypanosome. In 1903 Theiler considered the transmission of *T. theileri* to have been effected in South Africa by the Hippoboscids, *Hippobosca rufipes*, Olf., and *H. maculata*, Leach, but this cannot be held to be conclusive, as the possibility of transmission by other carriers, such as Tabanids and *Stomoxys* was not excluded. The scarcity of Hippoboscids on German cattle show that these flies cannot play an important rôle. It is far more probable that Tabanids are involved, as they harbour many flagellates. From available data the following list of Tabanids in which flagellates have been recorded has been compiled :—*Tabanus tergestinus* and *T. glaucopis* in southern France ; *T. socius*, *T. par*, *T. ditaeniatus*, *T. fasciatus*, *T. africanus*, *T. gratus* and *T. virgatus* in Egypt ; *T. hilarius* and *Tabanus* sp. in India ; *T. secedens* and *T. thoracinus* in East Africa ; *T. testaceomaculatus* in Chili ; *T. congolensis* and *T. taeniola* in the Island of Principe. To these the author adds *T. bovinus* in Poland, and *T. bromius* in Brandenburg. Other records include *Pangonia infusca* and *P. neavei* in the Congo ; *P. australis* in Chili ; *Haematopota italica* in southern France ; *H. pluvialis* in Germany ; *H. duttoni* and *H. vandenbrandeni* in the Congo. All those observers of Tabanid flagellates who have studied the site where the flagellates occur in the bodies of the flies state this to be the walls of the hind-gut, though Bruce occasionally observed them in the fore-gut. The author's observations only relate to flagellates attached to the hind-gut, and the dissected Tabanids showed none in their stomachs, indicating that the infections were not recent ones. All observations relate to flagellates from the blood-sucking females, which attack cattle and horses by preference. Only a small percentage of these females are infected, and in wet, cold years the infection is absent in localities where it had previously occurred. In cattle-breeding districts the flagellates are common in Tabanids during hot summers. These observations pointed to a connection between the Tabanid flagellates and *T. theileri*. Among the ways in which the exact experimental proof of such connection could be reached was the one provided by the size and the characteristic shape of the giant culture forms of *T. theileri*. A full account is given of the experiment, which proved that the flagellates from *Tabanus glaucopis*, Meig., are the developmental stage of *T. theileri*. It is thought probable that other Tabanid flagellates also represent the developmental stage of this trypanosome. This experiment further proves that the transmission is not a simple mechanical one. A bibliography of 14 works closes this paper."

Bouet (G.). Contribution à l'étude des zones à glossines du Sénégal (Région du chemin de fer de Thiès à Kayes). [The Tsetse-Fly Belts of Senegal (Area traversed by the Thies-Kayes Railway Line).]—*Bull. Soc. Path. Exot.* 1916. Dec. Vol. 9. No. 10. pp. 802–813. With 1 map.

This paper forms an interesting contribution to the study of the fly belts and trypanosomiases of West Africa, the district particularly dealt with being that traversed by the projected railway connecting Senegal with the Sudan. This railway is about 700 kilometres in length between Thies, near the western coast of Africa, and Kayes on the Senegal River, and the first 400 kilometres are already under construction.

The intensive cultivation of earth-nuts has led to the gradual clearing of the first 300 kilometres but beyond the cultivated areas there exists a dense vegetation of trees and shrubs. The vegetation varies somewhat as the railway line penetrates into the interior of the country, becoming rather rare as it passes along the border of the Ferlo desert; then again afterwards up to the Falémé stream, at the 575th kilometre, the vegetation becomes thicker containing new species, especially bamboos. The railway tract is in no part crossed by a permanent watercourse.

Although the conditions of the country through which the railway passes seem everywhere favourable to the existence of *Glossina morsitans*, yet this fly is only found between the 440th and 575th kilometre. The railway runs, however, through almost the same latitude from west to east, that is, between 14° and 15° N.

In a previous communication the author and ROUBAUD showed that this line formed the northern boundary of a *morsitans* belt consisting of the whole of that part of Senegal known as Upper Gambia and that this belt coincided exactly with the distribution of the big game. The belt extends southwards over the Gambia River into Guinea territory up towards the line Kadé-Yambéring. Its western limits appear to pass through Kolda in the French Casamance territory and then pass north-eastwards, skirting round the borders of British Gambia. A small belt was also discovered by ROUBAUD in the district known as Niom Bato in the Kaolack region adjacent to fly belts described in the British colony north of the River Gambia. It is probable that this small *morsitans* belt was formerly united to the Upper Gambia belt, but that the inhabiting and cultivation of the intervening districts caused the big game to migrate towards the sparsely populated Upper Gambia.

Towards the east *Glossina morsitans* can be found along the right bank of the Falémé stream and southwards through the villages of Satadougou and Dougasita.

The zone inhabited by *Glossina morsitans* in this part of French West Africa thus occupies an important area characterised by the abundance of big game and sparsity of population. These fly belts are also characterised by the presence of a breed of small cattle known as the N'dama or Fouta Djalon breed, very resistant to trypanosomiases and the tsetse fly, and which, like the big game, play the rôle of reservoirs for the virus. As soon as these animals can be replaced by hybrids and by zebus one may be sure that the tsetse fly does not exist in the district. The tsetse fly limits the extension southwards of the zebu in West Africa and makes it hardly possible to maintain the existence of hybrids.

A study of this region was undertaken by the author, at the request of the Government of French West Africa, on account of the heavy mortality among the caravan animals, especially the oxen, which brought food to the railway workers from the Sudan and from Upper Senegal and Nigeria.

The author then records the incidence of *Glossina morsitans* along a caravan tract constructed at a short distance from the railway line, commencing at Synthiou Coulé at the 440th kilometre; the last Glossina were captured at Naïes near the Falémé stream (575th kilometre). These fly catchings took place in September and October.

The number of females was insignificant compared with the number of males (three females for 75 males at one place on the 1st October), and thus it was thought that reproduction must take place at some other time of the year. According to the natives the flies disappear more or less completely during the dry season [*hivernage*] and only commence to reappear towards the end of September. They are especially abundant during the colder months (January, February and March), and their number diminishes as soon as the hot weather preceding the dry season is felt. Owing to the complete absence of permanent watercourses, except for a few wells which remain during the rainy season and become quickly dried up during the dry season, the conditions are such that no flies of the species *Glossina palpalis* are found in all this region.

Animal trypanosomiases. Experiments were made in order to determine whether the flies of the districts examined were infected and which trypanosomes they were capable of transmitting. A young sucking kid taken from a tsetse-free area was bitten from the 5th to the 23rd October with 88 *Glossina morsitans* captured in three villages. On the 24th October trypanosomes of the species *T. dimorphon* appeared in the blood and the goat died on the 21st November.

T. dimorphon has already been discovered in Upper Gambia and the disease caused by it is thus shown to extend further northwards. In these villages very few horses are found, these belonging to the chiefs only, who are obliged to replace them frequently. The work of railway construction had not penetrated into the fly area and thus out of about 50 horses and mules employed on the work only one was found infected. As the work proceeds there is no doubt that tsetse fly will cause a very considerable losses among horses.

As a rule horses do not survive for longer than one year in this area and care is then taken to keep them within the inhabited areas. Numbers of cattle of the N'dama breed in very good condition were seen in the tsetse area. In other villages just outside the area a certain number of various cross-breds were seen but very few of these could be found within the borders of the fly area.

In one village within the fly area examination of 100 cattle, 5 asses, 7 sheep, and 14 goats was negative. The sheep and goats belonged to the Fouta-Djalon (a southern) breed. According to the natives sheep and goats imported from Morocco die in from two to three months after their arrival in the country. Two out of three dogs of the village showed *T. dimorphon*; dogs appear to be very susceptible to this trypanosomiasis, and according to the natives they all die.

Outside the fly area blood examinations were also made of the various animals, the cattle for the most part being cross-breds and very rare cases of trypanosomiases were found. On the borders, trypanosomes were commonly encountered, especially in cross-bred cattle, sheep, and goats.

The author concludes that the Glossina of this area like those of the Upper Gambia area seem only capable of transmitting the trypanosomiasis due to *T. dimorphon,* and that at the present moment they are free from the other animal trypanosomes, *T. pecaudi* and *T. cazalboui,* of West Africa. It is feared that the passage to the Cold Storage Meat Factory now situated near the coast of Senegal of numerous herds of zebus, in particular from the Sudanese regions, may introduce into the Thies-Kayes area these other two viruses which *Glossina morsitans* is capable of transmitting. Inversely, the clean Sudanese herds passing through this area will become contaminated with *T. dimorphon*, but, as the majority of these animals are destined for slaughter the mortality from this disease will be very small, but infection will certainly be very large. The completion of the railway line will modify this state of affairs if care is taken to place the cattle in screened trucks as has been done on the Ivory Coast railway line.

The changes brought about by the migration of population along the railway line for the cultivation of earth-nuts will gradually cause the disappearance from this area of big game and, consequently, also of *Glossina morsitans.*

MACFIE (J. W. Scott). **The Results of Dissections of Tsetse Flies at Accra.**—*Report of the Accra Laboratory for the Year 1915.* pp. 49–54. With 1 plate. 2 tables and 4 text figs. 1916. London, W: J. & A. Churchill.

Examination of tsetse flies caught in the neighbourhood of Accra was undertaken on account of the great frequency of trypanosomiasis in cattle brought to Accra for slaughter. The flies were fed on various experimental animals and were dissected after having been confined for about three weeks, or at death if this happened earlier.

The following table shows the distribution of infection in the two species of flies caught.

Species of Tsetse Fly.	Number dissected.	Negative.	Spirochaetes in gut.	Sporocysts in abdomen.	Fungal infection.	Trypanosome Infections.				
						Proboscis, gut and salivary glands.	Gut and salivary glands.	Proboscis and gut.	Proboscis only.	Gut only.
G. palpalis ..	75	63	1	2	1	—	3	1	3	4
G. longipalpis ..	8	7	—	—	—	—	—	—	1	—
	83	70	1	2	1	—	3	1	4	4

"*Trypanosome infections.*—Morphologically the flagellates found in nine of the flies were of a pathogenic type, viz., those present in four infections of the proboscis, three of the gut and salivary glands, and two of the gut only. Three flies showed flagellates of the *T. grayi* type in the gut, and these parasites when alive were extremely active and were easily distinguished from the pathogenic types by this fact and by the extreme slenderness of their bodies. When fixed and stained they were seen to include both crithidial and trypanosome forms. The nucleus was large, oval, and situated towards the posterior end of the body; and the micronucleus was large and rod-shaped and was placed near the nucleus, sometimes being anterior to it, sometimes posterior. Two of the flies infected with flagellates of the *T. grayi* type had also a sporocyst infection of the abdominal cavity.

"With regard to the infections with flagellates of the pathogenic type it is difficult to decide what trypanosomes they represented in the absence of positive results from feeding and inoculation experiments. The common trypanosomes at Accra are *T. pecaudi* (*T. brucei* of Uganda), *T. vivax*, and *T. congolense*, and sleeping sickness is not known to occur at Weshiang where the tsetse flies were caught. It is probable therefore that all the infections of the proboscis were *T. vivax*, although three of the flies had been repeatedly fed on a goat without infecting it. The infections of the gut and salivary glands were possibly *T. pecaudi* (*T. brucei* of Uganda), and so were also perhaps the two infections with flagellates of a pathogenic type of the gut only. It must be remembered, however, that according to ROUBAUD *T. pecaudi* develops in the gut and proboscis, and not in the gut and salivary glands. None of the infections resembled stages of the development of *T. congolense*."

Other infections.—These consisted in the discovery of spirochaetes, a fungal infection, and sporocysts in specimens of *Glossina palpalis*; an interesting and minute description, illustrated with figures, is given of the two latter conditions.

OFFERMANN. **Ueber die serologischen Untersuchungsmethoden als Hilfsmittel zum Nachweis der Trypanosomenkrankheiten, im besonderen der Beschaelseuche.** [Serological Tests in the Diagnosis of Trypanosomiasis, especially in Dourine.]—*Arbeit. a. d. Kaiserl. Gesundh.* 1915. Sept. Vol. 50. No. 1. pp. 1–29. With 25 tables.

In this paper a series of experiments is described which were performed with the object of ascertaining the value of the complement and agglutination tests in the diagnosis of trypanosomiasis. The tests were performed on a dozen healthy rabbits which were inoculated at various times with certain quantities of the blood of dourine-infected guinea-pigs when trypanosomes were most abundant in their blood.

A full description of the technique employed in the complement test is given. All the rabbits were tested beforehand in order to determine the quantity of serum required to prevent haemolysis in the haemolytic system before infection. The antigen consisted of an extract of the trypanosomes obtained in a pure state from the blood of dourine-infected rats just before death by repeated washing and centrifuging. All the elements entering into the haemolytic system were carefully titrated beforehand and a full set of the necessary controls was utilised in each test. The stored serum of the rabbit before infection also entered into each series. A microscopic examination of the blood was made daily after infection together with the inoculation of mice in order to determine the first appearance of trypanosomes in the blood. Blood to be used in connection with the complement test was taken from a vein every two to six days after the first four or five days.

For the agglutination test, serum was procured from the rabbits in the same way, and the emulsion consisted of a suspension of trypanosomes obtained in the same manner as for the complement test. The serum was added in the required dilutions, the mixture allowed to remain in the incubator at 37° C. for five hours, and the results were then read off. The agglutination titer on the various dates on which serum was taken is given.

The clinical history is described in the case of each animal.

The author's general conclusions with regard to both these tests are as follows:—

"(1) Sera obtained from healthy rabbits possessed in many cases an inhibitory effect upon haemolysis.

"(2) A regularity in the appearance of the bodies causing the inhibition cannot be determined. While many sera proved very strongly inhibitory, in others this property was completely or almost completely absent.

"(3) In no case in the tests performed could an inhibitory action be observed following the use of 0·01 cc. or a smaller quantity of normal rabbit serum.

"(4) When the serum of a rabbit is to be used in researches in connection with the complement test the serum should be tested before infection.

"(5) No agglutinins causing agglutination of the trypanosomes of dourine could be discovered in normal rabbits.

"(6) In the serum of dourine-infected rabbits complement-binding anti-bodies and agglutinins could be discovered.

"(7) The anti-bodies did not always appear simultaneously. Generally, complement-binding amboceptors appeared earlier than agglutinins. While the first-named were traced as a rule 8–9 days after artificial infection, the latter took 12–13 days to appear.

"(8) The anti-bodies appeared later than the trypanosomes in the blood. The complement-binding amboceptors were traced 4–9 days, and the agglutinins 4–22 days, later.

"(9) The appearance of anti-bodies varied in time and quantity according to the individual animals and the course of the disease. The anti-bodies often decreased during the course of the disease, only to increase again towards the end. A regularity in the appearance of these phenomena could not be determined. In no case did they disappear altogether from the blood.

"(10) By storing the serum with sterile precautions the anti-bodies could be discovered after many months.

"(11) For the agglutination test fresh trypanosome emulsions must be used as they lose their activity when stored.

"(12) The antigens obtained from the trypanosome emulsions for the complement test retained their activity for many weeks when stored in an ice chest.

"(13) The complement and agglutination tests are useful diagnostic methods, as well as the inoculation of blood into white mice.

"(14) As the complement test gives better results than the agglutination test it is to be preferred for diagnosis."

MACFIE (J. W. Scott). **A Trypanosome of the Black Rat.**—*Report of the Accra Laboratory for the Year 1915.* pp. 72–73. With 1 coloured plate comprising 10 figs. 1916. London, W.: J. & A. Churchill.

The author describes polymorphic trypanosomes of the *T. lewisi* type found in immense numbers in the blood of a young black rat (*Epimys rattus*). The longest measured 48μ, the shortest 15μ, average 30·02μ. In breadth they averaged 2·6μ and ranged from 2μ to 6μ. Four types of parasite could be distinguished with intermediate stages between them.

The majority were about 30 to 35μ in length and 2μ in breadth, possessed a well-marked free flagellum, and the posterior extremity was prolonged for a considerable distance beyond the micronucleus.

Very much smaller trypanosomes, some of which measured only 12μ in length were fairly common and in them the posterior end tapered rapidly into a finely pointed cone, and the micronucleus was not infrequently situated alongside of or even slightly anterior to the macronucleus.

Larger broad forms measuring 6 microns at their widest part were also seen.

These three types were very similar to those described by DELANOË (1915) as typical of *T. eburneense*, the first type representing the adult and the other two the multiplicative forms.

In addition, there were some remarkable forms with the posterior end prolonged into a whip-like extension sometimes about 24μ in length. These trypanosomes measured up to 52μ in length and 3 or 4μ in breadth. Intermediate forms were found which seemed to link this type with the commonest form of trypanosome present in the blood. Similar forms were found by LINGARD (1906) in rats. The name *T. longocaudense* was originally proposed for them, but subsequent observations have proved them to be forms of *T. lewisi* which are of "constant occurrence and very numerous at a certain stage of the multiplication period" (MINCHIN, 1912).

VAN SACEGHEM (R.) & NICOLAS (E.). **L'émétique dans le traitement des trypansomiases.** [Tartar Emetic in the Treatment of Trypanosomiases.]—*Bull. Soc. Path. Exot.* 1916. Dec. Vol. 9. No. 10. pp. 813–823.

Reference is made to the researches of PLIMMER and THOMSON and other workers on the use of ordinary tartar emetic, potassium acid antimony tartrate, and its efficacy in the treatment of trypanosomiasis. Mention is also made of the curative results obtained by Van Saceghem in the treatment of all bovines infected with *T. cazalboui* in the Belgian Congo. A therapeutic dose (6 mg. per kilog.), administered subcutaneously, causes the disappearance of trypanosomes in eleven minutes from the peripheral circulation of guinea-pigs infected with *T. ugandae* and *congolense*.

In view of this rapid disappearance of trypanosomes from the peripheral blood following treatment, the question arises as to where the trypanosomes which bring about relapses originate. It appears impossible that there remain forms in the blood capable of resisting the drug because no such forms have been demonstrated by any observer, and if these existed the blood would remain infective which, however, is not the case in animals that have just been treated ; also, if the inoculation of trypanosomes into a susceptible animal is combined with the injection of a therapeutic dose of tartar emetic infection is prevented.

One must thus admit that if no trypanosome escapes the action of the drug in the peripheral circulation there are organisms disseminated in various parts of the body, separated from this circulation, and not submitted to its action.

The serum of guinea-pigs which have received a fatal dose of the drug has no trypanocide action in vitro. The drug therefore disappears quickly from the circulation, or else it becomes rapidly transformed locally, or becomes excreted. Its short stay in the peripheral circulation is, however, sufficient to enable it to exterminate all the organisms which multiply in the blood but its "penetrating" action is too small to enable it to reach the trypanosomes hidden in the deeper tissue channels. These trypanosomes serve as the strain which re-infects the peripheral circulation after the necessary period of incubation. It may be that the multiplication of the trypanosomes is also retarded by the formation of antibodies.

When the serum (e.g., of a horse) is added drop by drop to 10 cc. of a saturated solution of tartar emetic an abundant albuminous precipitate is formed which becomes dissolved in a slight excess of serum as well as in alkalis or alkali carbonates. This precipitate does not appear in solutions of antimony tartrate to which common salt has previously been added, or in very dilute solutions. In intermediate concentrations it is replaced by a more or less marked turbidity.

An abundant precipitate is formed if one adds to the mixture of serum and tartar emetic an acid solution (e.g., of tartaric acid), in an excess of which it is not soluble. It thus seems that the alkalinity of the serum when present in sufficient quantity prevents precipitation.

The blood serum, the alkalinity of which is especially due to $NaHCO_3$ and Na_2HPO_4, first of all neutralises the acidity of the tartar emetic and then if present in sufficient quantity causes the appearance of another white, powdery, very fine precipitate composed of a mixture of calcium tartrate and antimony oxide. This precipitation is sometimes slow in appearing.

Experiments in vivo.—If a mixture of equal quantities of a 2 per cent. solution of tartar emetic and horse serum is injected into a mouse it is found that the trypanocide action of the drug is retarded.

It was also found that the addition of serum to the drug diminishes its irritant action in the connective tissue.

The white antimony precipitate, which excess of serum forms in a solution of tartar emetic, injected after washing and centrifugation into a trypanosome-infected mouse, does not possess any direct trypanocide action capable of manifesting itself after a relatively brief interval.

Tartaric acid has no trypanocide action *in vivo.* The administration of 0·01 gramme of tartaric acid into a mouse infected with nagana has an inhibitive effect on the action of a therapeutic dose of tartar emetic. This acid becomes transformed into sodium tartrate in the blood and it has no trypanocide properties, but impedes the action of the emetic.

Hydrochloric acid, at 1 per cent., has no trypanocide action.

Sodium bicarbonate and carbonate markedly diminish the toxicity of tartar emetic.

Experiments in vitro.—Sodium bi-carbonate and carbonate in isotonic solutions have no action on trypanosomes. Solutions of these substances added to a solution of tartar emetic diminish its trypanocide properties.

Tartaric acid used in a 2 per cent. solution has a marked trypanocide action. Previous neutralisation with sodium carbonate prevents this action.

It appears from this result that it is the SbO group of tartar emetic which has the trypanocide property since the tartaric radicle taken separately is, after neutralisation, devoid of all harmful effect on the trypanosomes; it, however, has advantages in that it presents the antimony in a form soluble and stable in the presence of water, easily diffusible and capable of acting more rapidly and more energetically than other forms on the parasites it comes into contact with.

Administration of tartar emetic.—Subcutaneously, the drug produces a considerable swelling and often sloughing but intravenous injections of watery solutions are well supported by man and the lower animals.

Van Saceghem introduced the method of administering the drug into the deep muscle tissues of the neck, after which no abscess formation took place. The drug is held in as fine a suspension as possible or in liquid paraffin in order to diminish its irritant effect on the connective tissue. Camphor, which can be dissolved in the oil, further diminishes the irritant effect on account of its sedative properties. The addition of 5 per cent., for example, of horse serum also causes it to lose in part its irritating properties. These oily camphorated suspensions of the drug are well tolerated after intravenous injection.

By retarding the diffusion of the drug in the blood these suspensions should diminish the toxicity of the substance, and thus allow of larger doses being employed and prolong the duration of its action.

Treatment of trypanosomiasis.—Tartar emetic kills *T. cazalboui* in vitro in solutions of 1/20,000. In the treatment of trypanosomiasis due to *T. cazalboui, congolense, evansi*, and *equiperdum* (mouse), almost uniformly successful results have been obtained, but in the case of other trypanosomes, such as *T. brucei, gambiense*, and *equinum* (mouse), the results are not consistent. The authors believe that failures in the case of the latter trypanosomes are due to their residing in the deeper tissue spaces of the body which are not reached by the drug. The affections produced by trypanosomes transmitted mechanically and hence requiring their presence in large numbers in the blood, hardly ever resist the therapeutic action of the drug. Van Saceghem has thus shown that bovines affected with *T. cazalboui* can be cured by means of a single intramuscular injection of a medicinal dose of tartar emetic.

The various methods of administration are dealt with as follows :—

Large doses dissolved in water are very toxic producing a general depressant action, especially on the heart.

Administration in oily suspensions prevents rapid diffusion and allows of a widespread action of the drug and of larger doses being used. The addition of camphor to the oil has moreover a considerable cardiac tonic effect.

The emulsion is made up as follows :—The tartar emetic is ground up in a mortar as finely as possible and then mixed with some oil into a homogeneous mixture. It is then poured into a flask containing some glass beads and sterilised in a water bath or, if possible, in an autoclave at 110° C. for 15 minutes. After cooling the desired quantity of camphor (10 to 20 per cent.), previously dissolved in a little ether, is added. Before use, the mixture is well shaken up and here the glass beads assist in emulsification.

Subcutaneously, a dose of from 4 to 6 mg. of tartar emetic per kilog. is employed in the case of the large animals and the desired amount is made up to 100 cc. with camphorated oil.

Administered by the mouth the drug has no effect.

Intravenous administration is very effective and the dose given is from 1 to 2 grammes, in the case of the large animals, dissolved in physiological salt solution. Broden and Rodhain have shown that fewer cures are obtained by intravenous than by subcutaneous administration. The authors recommend the introduction intravenously of the drug in an oily camphorated solution as it is thus very well tolerated by animals.

Administered intramuscularly in a dose of 6 mg. per kilog. in 50 cc. of salt solution, the local reaction is *nil* or transient. When administered according to the technique described by the authors no abscess at the seat of injection. The oily suspensions are well suited for this mode of administration and one would employ two grammes of tartar emetic in 100 cc. of camphorated oil.

(g) MISCELLANEOUS.

LOW (G. C.). **The History of the Use of the Intravenous Injections of Tartar Emetic (Antimonium Tartaratum) in Tropical Medicine.**—*Trans. Soc. Trop. Med. & Hyg.* 1916. Dec. Vol. 10. No. 2. pp. 37–42.

The credit for first proposing the use of antimony salts in tropical medicine, viz., in trypanosomiasis, is given to NICOLLE and MESNIL (1906) who were led to suggest it on account of the unsatisfactory results obtained with atoxyl and other arsenic compounds. Reference is also made to the successful results obtained by PLIMMER and THOMSON in 1907 in the treatment of experimental trypanosomiasis.

BRODEN and RODHAIN (1906 to 1908) first tried the effect of administering large doses intravenously to natives suffering from sleeping sickness.

In the treatment of leishmaniasis the first records of the use of tartar emetic injections were made in 1913, when MACHADO and VIANNA successfully treated cases in this manner in Brazil. In the same year ARAGAO and VIANNA treated cases of ulcerating granuloma of the human subject by the same method with excellent results. Further details with regard to the treatment of these diseases by this method are given, together with a list of published papers.

A history of the treatment of trypanosomiasis of the domesticated animals by this method has, unfortunately, been omitted.

CASTELLANI (Aldo). **The Treatment of Certain Diseases of Protozoal Origin by Tartar Emetic, Alone and in Combination.**—*Brit. Med. Jl.* 1916. Oct. 21. pp. 552–553.

Although this article deals exclusively with the treatment of human diseases, a study of the methods employed and the results obtained will undoubtedly be of value in so far as they indicate comparable lines of treatment which might be adopted in the diseases of protozoan origin of the domesticated animals.

"Tartar emetic is of great efficacy in various protozoal diseases. Its powerful action in trypanosomiasis has been well proved, and it can be used as a specific in espundia, granuloma inguinale, kala-azar, and oriental sore. It is efficacious in yaws, especially if combined with other drugs, and seems to have a beneficial action also in relapsing fever."

Various formulae are given, in which tartar emetic constitutes the active ingredient, for oral, intravenous, and intramuscular administration in the diseases enumerated.

Intramuscular injections are stated to be extremely convenient, but the usual solutions of tartar emetic are very painful when given in this way and may induce the formation of an abscess. The following represents one of the formulae devised with the object of eliminating this irritant action:—Tartar emetic, 8 grains; carbolic acid, 10 minims; glycerine, 3 drachms; sod. bicarb., ⅓rd grain; distilled water up to

1 oz. In the case of the human subject affected with kala azar ½ to 1 cc. of this mixture is injected intramuscularly every other day in the gluteal region.

MACFIE (J. W. Scott). **Bodies Resembling *Paraplasma flavigenum* in Men and Animals.**—*Report of the Accra Laboratory for the Year 1915.* pp. 58–63. With 2 plates (1 coloured) comprising 11 figs. and 1 chart. 1916. London, W: J. & A. Churchill.

In this paper the author refers to SEIDELIN's discovery (1911–1912) in Mexico of *Paraplasma flavigenum* in the red corpuscles of a few human subjects who presented no symptoms of yellow fever, and were considered to be pseudo-carriers of the disease.

The history is given of a disease characterised by fever and debility affecting a European and a native, respectively, in West Africa; the cause of the disease could not be determined but bodies resembling *Paraplasma flavigenum* were found in blood films.

The author discusses the etiological significance of *Paraplasma flavigenum* in yellow fever. The occurrence of similar bodies in guinea-pigs after inoculation with the blood of patients suffering from yellow fever at Lagos in 1913 was discovered by the author and JOHNSTON, but at that time none could be found in the blood of clean guinea-pigs. Subsequently the author found Paraplasma-like bodies in uninoculated guinea-pigs. CONNAL and JOHNSTON (1915) found red-cell inclusions resembling *Paraplasma flavigenum* in nearly 26·5 per cent. of the guinea-pigs they examined at Lagos.

WENYON and LOW (1914) also observed these bodies in guinea-pigs and accordingly attempted to disprove the parasitic nature of *Paraplasma flavigenum* and to discredit the experiments in which these bodies appeared to have been transmitted by inoculations.

In CONNAL and JOHNSTON's experiments the guinea-pigs found to harbour Paraplasma-like bodies after inoculation with yellow fever blood did not in any single case show them before the experiments were begun.

When guinea-pigs were inoculated with normal human blood they found that the pyrexia "was comparatively slight, and the charts differ distinctly from those which recorded the temperature of yellow fever guinea-pigs."

MACFIE (J. W. Scott). **A Further Note on a Disease of Fowls characterised by Inclusions in the Leucocytes.**—*Report of the Accra Laboratory for the Year 1915.* pp. 68–70. With 1 chart. 1916. London, W: J. & A. Churchill.

In this short article, the author describes a fatal disease in a turkey in which inclusions were found in the leucocytes similar to those described by him in 1914 in an outbreak of disease among fowls at Eket in Nigeria [see this *Bulletin*, Vol. 3, No. 1, p. 27].

During life the turkey showed symptoms of marked depression and slight diarrhoea; on examining the blood a few pigmented parasites of the Halteridium type were found in the red blood corpuscles, and a atoxyl proved unsuccessful and the turkey died on the 4th day; post-mortem examination revealed no gross lesions; the tissues were not anaemic, and the liver and spleen were enlarged.

0·5 cc. of the blood was inoculated subcutaneously into a fowl. Inclusions were found in its leucocytes on the fourth day, and fever and other symptoms afterwards set in. The bird died on the 10th day. The liver and spleen were both enlarged, and inclusions were found in the latter organ similar to those found in the turkey.

Another fowl inoculated subcutaneously with the heart blood of this fowl also developed symptoms of illness on the fourth day, and later a high temperature together with a few inclusions in its leucocytes. By the 11th day it had apparently recovered from the infection, but it did not regain its normal condition until many weeks later.

Two chickens inoculated with blood from this second fowl on the 6th day did not become infected.

The disease in the turkey thus appeared to be not so virulent as that observed in the case of the Eket fowls.

BAYON (H.). **The Development of Pathogenic Properties in Protozoa, with Special Reference to the Herpetomonad Group.**—*Trans. Soc. Trop. Med. & Hyg.* 1916. Dec. Vol. 10. No. 2. pp. 23–32.

This is a purely theoretical paper dealing with the probable evolution of pathogenic properties in protozoa in the light of recent advances in our knowledge of the developmental cycles and incidence of certain protozoa which cause disease in man and other vertebrates. Protozoa of medical interest are tabulated according to their mode of life and pathogenicity. The author classifies spirochaetes in the same manner as FANTHAM who states "that spirochaetes are intermediate in character between bacteria and protozoa, showing morphological affinities with bacteria and physiological and therapeutical (biological) affinities to protozoa."

The principal features and properties of protozoa capable of causing disease in man and other animals are reviewed, and from this classification the author claims to show "that the parasitic protozoa which have the most marked pathogenic properties for man and mammals are those which, as a rule, can be definitely distinguished morphologically from their saprozoic harmless relations." He excludes from this rule the Herpetomonad group. "The pathogenic, even lethal properties of *Leishmania donovani*, and the extreme similarity of its herpetomonad stage to saprozoic races, are a definite and glaring exception to this rule which requires separate attention and explanation."

In discussing the trypanosome group the author concludes that in the case of trypanosomes of great virulence such as *T. rhodesiense*, *gambiense*, *evansi*, *brucei*, etc., the adaptation to a certain form of parasitic life has become so permanent that a reversion to simpler forms is no longer possible. "On the other hand *T. lewisi* with all its mild pathogenic properties adapts itself easily to varying conditions (cultural, etc.), and in so doing repeats its ontogenetical development in a somewhat similar fashion to what has been observed in the embryonal stages of vertebrate life."

In dealing with the herpetomonads the author refers to the experiments of Fantham and Porter, and quotes their conclusions *in extenso* (see this *Bulletin*, Vol. 4, pp. 23 and 146).

He also refers to his own discovery of herpetomonads in the cloaca of *Chamaeleon pumilus* at Robben Island in 1913. He concludes that in the case of diseases such as kala azar "it is quite possible that this group of diseases is acquired by the inoculation through blood-sucking insects of apparently free-living or saprozoic varieties."

A discussion of the behaviour of the pathogenic spirochaetes and amoebae concludes the paper.

DISEASES DUE TO METAZOAN PARASITES.

Roubaud (E.). **Les Porcins et la conservation des Ectoparasites humains, dans les régions chaudes.** [The Rôle of Pigs in the Maintenance of Human Ectoparasites in the Tropics.]—*Bull. Soc. Path. Exot.* 1916. Dec. Vol. 9. No. 10. pp. 768–771.

In the course of his researches on the Auchmeromyia the author noted a striking relationship between these blood-sucking larvae found on man and those found on two species of animals (Phacochoerus; Orycteropus)* that are very common in Tropical Africa, live in burrows, and possess a hairless skin. The Cheromyia larva found in the burrows of Phacochoerus and the human Auchmeromyia larva commonly known as the "Congo floor maggot" (*ver des cases*) found on negroes are strictly related inasmuch as both types can be reared experimentally on the pig or on man. It thus appears that, depending on the prevailing conditions, a substitution may take place between the hosts.

The author enumerates a series of ectoparasites which have been established as capable of living on animals or on man. Examples of these are the human tick, *Ornithodorus moubata*, the vector of "tick fever," found by Lloyd in Rhodesia in the burrows of Phacochoerus in uninhabited districts; Wellman in Angola and van Saceghem in the Belgian Congo have also found this tick in the styes of domestic pigs.

The chigger flea of man, *Sarcopsylla penetrans* L., known in Brazil as the *bicho de porco*, was found by van Saceghem at Zambi in such abundance on pigs as to form veritable walls around the feet, mammary glands, and scrotum.

With regard to biting flies it is stated that in the Island of Principe the tsetse fly best adapted to man, *Glossina palpalis*, is also the common fly found on wild pigs. The Portuguese Commission on Sleeping Sickness found that the distribution of the *palpalis* in the Island corresponded exactly with the migrations of large bands of half-wild pigs. The extermination of these pigs rapidly brought about the disappearance of these insects.

The mange sarcopt of the pig is easily transmissible to man, whereas it has no other hosts; the goat sarcopt is transmissible to both man and the pig. NOELLER, working recently on the transmission of typhus, found that the pig louse remains a long time alive on man and inversely the louse of human clothes may remain alive for seven days or longer on the pig.

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* "Phacochoerus is the wart hog, an African genus of pigs (Suidae). Orycteropus has nothing to do with the pig-family, although superficially like a pig. It is an anteater usually classified in the Edentata."—R. J. Pocock, F.R.S., F.L.S.

From these data the author concludes that pigs show themselves to be the animals most nearly related to man as far as the possibilities of the nutrition of ectoparasites are concerned.

ROUBAUD (E.) & VAN SACEGHEM (R.). **Observations sur quelques insectes et acariens parasites du bétail au Congo Belge.** [Some Insect and Acarian Parasites of Cattle in the Belgian Congo.]—*Bull. Soc. Path. Exot.* 1916. Dec. Vol. 9. No. 10. pp. 763–767.

These observations were made at the Veterinary Establishment at Zambi, in a country where until recently stockbreeding had never existed.

(1) *Larvae producing animal myiases in the Lower Congo.*

(*a*) Bot Oestridae.—In the digestive tract of an elephant killed in the Kassai district were found two species of Cobboldia larvae in their third stage. One of these was identified as *Cobboldia loxodontis* Brauer, and the other corresponded with a species recently described by RODHAIN and BEQUAERT under the name of *C. chrysidiformis.*

In the stomach of asses of the Lombardy and Poitou breeds introduced in 1911 larvae corresponding to the type *Gastrophilus intestinalis* of Europe were found. The rearing of some of these produced adults very similar to the form *G. asininus* identified by BRAUER.

It is interesting to note that these parasites are the result of an external importation and local acclimatisation of the species. Originally there were no bots in the Lower Congo on account of the absence of equines, the first animals capable of harbouring these parasites having been brought from Senegal in 1911.

No warble Oestridae were observed on domestic animals or on the wild mammals.

(*b*) Muscidae.—Myiasis due to *Chrysomyia* (*Pycnosoma*) *bezzianum* Vill. (=*megacephala* Bezzi) is frequent among the bovines of the station. Hitherto this myiasis has only been observed in the case of the large domesticated animals,—cattle and horses. It is found also at Zambi on pigs, especially about the ears and scrotum. It was also found on a young domesticated antelope and thus it is probable that the myiasis actually occurs among wild mammals. Cases of the disease always appear as wound complications.

Myiasis due to *Lucilia argyrocephala* Macq., which has hitherto only been found in mammals including man, appears also very widespread among birds. The adult flies of this species were obtained by rearing larvae collected from the wounds of a Barbary duck. Larvae corresponding exactly with the same species were obtained on a fowl. Also pupae collected in the nest of a Tisserins bird (*Ploceus collaris*) developed into the same species of Lucilia. In these nests were also found pupae of *Passeromyia heterochaeta* Vill., a muscid blood-sucking larva of Congo birds, the life-history of which has been described by RODHAIN and BEQUAERT. It appears that the myiasis due to *L. argyrocephala* in birds is consequent upon the antecedent parasitic action of the blood-sucking larvae of Passeromyia; the multiple cutaneous erosions produced by the bites of these larvae and the lesions resulting from scratching in the young birds appear to constitute a port of entry for the parasite producing the myiasis.

(2) *Biting flies and acari on cattle at Zambi.*

Tabanidae.—*Haematopota perturbans* Edw. [see this *Bulletin*, Vol. 4, No. 4, p. 159 for probable rôle in the transmission of *Trypanosoma cazalboui*], *Tabanus canus* Karsch, *T. ditoeniatus* Macq., *T. pluto* Walk., *T. par* Walk., *T. biguttatus* Walk., *T. taeniola* P. B.

Stomoxydae.—*St. calcitrans* and *Lyperosia pallidipes* Roub. are very common on cattle.

Hippoboscidae.—None have yet been observed in spite of the importation of equines.

Pulicidae.—The chigger flea of man, *Sarcopsylla penetrans* L., infests pigs in such large quantities that it forms a veritable obstacle to breeding. The wounds it produces may become gangrenous. The feet, scrotum, and the mammary glands of sows are the parts most often affected. The chigger of fowls, *S. gallinacea* West., is frequent around the eyes of poultry, and it may also infect domesticated cats.

Pediculidae.—*Haematopinus suis* L., is found in abundance on native and imported pigs; on cattle *H. eurysternus* Nitzsch. has been observed around the eyes. *H. tuberculatus* Grib. var. *penicillatus* was found on a buffalo imported from Italy.

Acarinae.—Psoroptic otacariasis is fairly widespread. This disease is also observed in the sheep with the same characters as in the case of the goat; the conchal cartilage is filled with greyish-yellow, compact, very irregularly shaped crusts in which the parasites are found. The morphological characters of the parasites observed in the case of the goat and in the sheep are the same.

Among domesticated rabbits auricular psoroptic mange is also very common, and is of European origin. Likewise *Dermanyssus gallinae* and *Cnemidocoptes mutans* are very common on poultry, and *Chorioptes equi* Her., the cause of symbiotic mange in the horse, is always found among the equines of the station.

Among the Ixodidae collected at Zambi on animals the authors have been able to identify *Rhipicephalus appendiculatus* Neumann, *Rh. simus* Koch, *Rh. capensis* Koch, *Amblyomma variegatum* Fabr. and *splendidum* Giebel, and *Margaropus annulatus* Say, and on an elephant from Kassai, *Amblyomma tholloni* Neumann. Also, in the piggeries in the district of Paso-Kondé the human tick *Ornithodorus moubata* was observed in great abundance in the rotten wood of the pigstys. Relapsing fever has not been discovered in the district and Argas is unknown to the natives. The examination of some Ornithodorus for spirilla proved negative. This was the only district in which these Argasidae were found.

MORSTATT (H.). **Bestimmungsschlüssel der in Deutsch-Ostafrika bekannten Tsetsearten.** [The Tsetse Flies of German East Africa.]—*Arch. f. Schiffs- u. Trop.-Hyg.* 1914. Aug. 2. Vol. 18. No. 16. pp. 574–575.

A description is given of the external diagnostic characters of the tsetse flies in German East Africa, viz., *Glossina palpalis* R. D., *Gl. austeni* (*tachinoides*) Newst., *Gl. morsitans* Westw., *Gl. pallidipes* Aust., *Gl. brevipalpis* (*fusca, tabaniformis*) Newst.

GLAESER (Hans). **Bestimmungsschlüssel der in Kamerun und Togo bekannten Tsetsearten.** [The Tsetse Flies of the Cameroons and Togoland.]—*Arch. f. Schiffs- u. Trop.-Hyg.* 1914. Aug. 2. Vol. 18. No. 16. pp. 571–573.

The external diagnostic features are given of the known tsetse flies of these countries.

Cameroons.—*Glossina ziemanni* Grünb., *Gl. tachinoides* Westw., *Gl. caliginea* Aust., *Gl. palpalis* Rob-Desv., *Gl. pallicera* Big., *Gl. tabaniformis* Westw.

Togoland.—*Gl. palpalis* Rob-Desv., *Gl. longipalpis* Wied., *Gl. morsitans* Westw., *Gl. fusca* Walk.

*VEGLIA (F.). **The Anatomy and Life-History of** *Haemonchus* (*Strongylus*) *contortus* (Rud.).—*Union of South Africa. Third & Fourth Reports of Director of Veterinary Research.* 1915. Nov. pp. 347–500. Extracted in the *Jl. Comp. Path. & Therap.* 1916. Sept. Vol. 29. No. 3. pp. 265–277.

Free Life.

The Egg.—Eggs were obtained for examination and for cultural purposes by making a decoction of faeces, passing through a sieve, repeatedly sedimenting the liquid and centrifuging the sediment, from which the eggs were collected by means of a pipette. The egg is oval and measures on an average 70·9 by 45·9μ and when laid by the female is mostly found to be in the four-cell stage. In the stomach of the host eggs at the 6-, 7- and 11-cell stages may be found, and exceptionally at the "morula" stage. No eggs beyond the "morula" stage are ever found in the intestinal tract.

Under favourable conditions after 12 hours the eggs obtained from faeces or laid by females show distinct movements of the embryo within them and by the 17th hour about 50 per cent. of the eggs were found to have hatched. The remainder hatched slowly, but by the 48th hour only a few eggs had not hatched. Hatching of the embryo appears to take place by rapid pushing movements of the head against the shell wall. Eggs obtained from faeces were found to hatch sooner than eggs laid by the female, this being probably due to the fact that while the eggs are passing through the intestines the evolution of the embryo continues.

Larvae.—Different methods were used in the cultivation of the larvae according to the object in view. For diagnostic purposes faeces moistened with water if necessary were placed in a thin layer at the bottom of a suitable covered glass vessel, and placed in an incubator at 26°–35° C. or kept at room temperature. If development occurs the larvae are seen to crawl up the wall of the vessel four days later and can be recognised as white masses branching out in various directions.

When the object was to obtain a large stock of larvae the normal droppings of sheep were found to be the best medium. These were placed in a jar 9 cm. in diameter and 20 cm. high, which was covered with a lid and kept at room temperature. Sufficient air was available inside to permit of the eggs hatching but when fermentation took place all further development ceased. Diarrhoeic faeces and material from the caecum and colon gave very poor results.

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* A short reference to this article has already been made in this *Bulletin* (1916. Dec. Vol. 4. No. 4. p. 166). The above extract of the parts dealing with the bionomics of the worm is inserted at the request of a reader.

For studying the larvae liquid or solid media were used. The best liquid medium was found to be a boiled and filtered decoction of sheep's faeces placed in a layer of about 1 to 3 mm. in thickness at the bottom of a Petri dish; after inoculation with eggs this was enclosed in a covered evaporating dish, and placed in an incubator. Larvae could then be examined microscopically from time to time at room temperature without affecting the rate of development. The best solid medium was found to be a 0·5 per cent. agar concentration, prepared in the same way as the liquid medium.

Eggs placed in pure water were found to hatch but the larvae did not develop and soon died of starvation.

Development of the larvae.—In their evolutive cycle the larvae of *Haemonchus contortus* pass through five stages, separated by structural changes. The first two stages and part of the third one are passed outside the host as free larvae. The second part of the third stage and the fourth and fifth stages are passed in the hosts as parasites. Each stage can be divided into two sub-stages, viz., the first one in which the larvae move rather actively, feed, and develop and a second one in which the larvae are found in a lethargic condition when they neither move nor feed, but undergo structural change. Entering the fifth stage the worm is sexually mature, and is usually called the adult worm.

First Stage.—The naturally hatched larvae vary in size from 340 to 350μ by 15–20μ, and belong to the rhabditiform type. The body is cylindrical, decreasing in thickness from the base of the oesophagus to the tail. After executing a series of active wriggling movements for about an hour after hatching, the larvae commence to feed and steadier movements, which are somewhat slow, are noted. The chyle intestine cells become packed with granules, the larvae stop feeding, become stationary, and enter into the first lethargic condition; this takes place in from 10 to 12 hours, or 24–27 hours after the eggs have been passed by the host. After 8 or 10 hours the larvae revive.

Second Stage.—Ecdysis first of all takes place and the larvae soon increase in size to 500μ, and the lateral lines on the skin become conspicuous. The larvae show active swimming movements, begin to feed again, and the intestinal lumen becomes straightened out and increases in diameter. When sufficient food has been obtained the larvae again move with the object of hiding in the interior of the medium and the second lethargic stage sets in. The beginning of the second lethargus seems to take place after 40 hours after the first ecdysis, or 50–60 hours after the hatching. After about 12 hours the development of the lethargic stage is completed and with the accomplishment of the rather pronounced structural changes the larvae awaken.

Third Stage.—The Mature Larvae. The larvae awaken from the second stage as soon as conditions are favourable, in general three days after hatching. They now execute swimming movements which are fast compared with those noted in the second stage. Another peculiarity is the attempt of the larvae to rise, their object being to reach a suitable locality from which they can find access to the host.

Ecdysis next takes place. In size they varied between 571 by 21μ to 820 by 26·5μ. A certain contraction of the tissues takes place by which the size of the body sensibly decreases while the outer skin becomes thicker and increases in rigidity. Vacuoles in varying numbers and of different sizes are present in the chyle intestine cells and these vacuoles become especially frequent in larvae exposed to unfavourable conditions such as dryness, light, or heat.

Influence of the Environment on the Eggs and Larvae.

Toxic substances produced in the intestine of the host or in faeces as the result of abnormal fermentation interfered with the evolution of the egg and sometimes effected its destruction. Similarly certain chemical compounds such as beta-naphthol, thymol, and picric acid, were tested on eggs and found not only to inhibit development but actually to destroy the vitality of the egg.

A certain amount of air is required for development. The amount needed is very small, but if it falls below a certain minimum inhibition of growth and finally death will occur. Cultures of faeces thus do not develop if made into too thick a paste with water or if carried out in liquid media more than 3 mm. in depth. More air seems to be required for developing eggs and larvae than for resting eggs and mature larvae. Mature larvae kept in water at a depth of 3 cm. were still alive after three months.

Temperature.—The optimum temperature for the development of eggs and larvae was found to be between 20° and 35° C. Accordingly, the author calls normal temperature that lying between 20° and 35° C., high temperature that above 35° C. and low temperature that below 20° C.

A very large number of laboratory experiments were made on the development of the worm at these temperatures, the resistance to extremes of temperature, and the effect of alternating temperatures.

With regard to the effect of various temperatures in the field the following statements are made:

"In considering first of all high temperatures, the maximum recorded in South Africa under conditions of cloudy moist weather cannot be considered to prevent the development or to kill the larvae of *Haemonchus contortus*. In sunny weather, when the ground is moist, the larvae lying in wet earth or faeces are not necessarily exposed to the same maximum of temperature as that of the atmosphere. Moreover, in these conditions the larvae are able to escape from direct sunlight and shelter in cooler places. The high temperatures experienced on the veld during the summer time help to kill a large number of larvae but, at the same time, many of these larvae can be killed before the maximum temperature is reached. The average summer temperature in South Africa is very favourable for the development of the larvae of *Haemonchus contortus*.

"Concerning the low temperatures experienced in South Africa it may be said that the normal spring and winter temperatures do not prevent the development of eggs or larvae but prolong the period required before the larvae reach maturity. The resistance to adverse conditions of eggs and larvae, and their ability to develop considered in relation to the effects of temperature in the winter season of South Africa depend chiefly on the absence of uninterrupted spells of low temperature; the minimum even if occasionally very low only lasts for a short time during the night, whilst in the daytime the average is the optimum temperature required for the growth of the larvae. In a moderate cold ambient, the larvae also remain in a better state of preservation and for a longer period than in warm weather."

Moisture.—The best consistency of faeces for the hatching of eggs and growth of larvae has been referred to above. It was found that in a liquid medium kept immobile and deeper than ½ cm. a rather small percentage of the eggs hatched after four days, but the larvae made very little progress and within 12–15 days death occurred, presumably owing to lack of air.

The mature larvae appeared to find in water a suitable medium for preservation. A small percentage were found to be living up to the fifth month. The pools of water in the veld thus appear to constitute a suitable environment and to a certain extent a favourable place for infecting the host. The mature larvae appear to prefer pure water to faeces.

With regard to the action of desiccation on mature larvae the following conclusions were arrived at:—

"(1) The larvae of *Haemonchus contortus* do not resist complete desiccation and die before this condition is reached, but under natural conditions they resist (on account of their peculiar structure) the progress of desiccation for a comparatively long time.

"(2) The larvae preferably remain in moist surroundings and by migrating are in a position to seek shelter where the moisture is more constant.

"(3) When dryness sets in the larvae gather in clusters, a peculiarity which can easily be observed under the microscope. These clusters play an important rôle in the preservation of larvae in the field against drought, chiefly when the larvae are surprised on grass by the evaporation of dew or rain."

In a number of laboratory experiments it was found that mature larvae lived for five months in water whilst in dry faeces in the same room after eight days 50 per cent. were dead, and in the desiccator the majority died within four days.

Light.—The eggs and larvae develop under conditions of light such as are observed during the night time or in an incubator. The larvae do not reach maturity if exposed to a diffused bright light during the day. If the diffused light is weak as is noticed in rainy weather they reach maturity equally as well as they do in darkness. In faeces exposed to a strong diffused light the larvae grow as usual; it seems that the larvae pass a certain part of their developmental period on the surface of the pellets when in diffused light. Direct sunlight appears to have a very destructive effect as the larvae hatched out of eggs thus exposed were found invariably killed at the end of the second day; mature larvae were nearly all dead on the fourth day of exposure.

With regard to the action of the sun on infected faeces in the field the following general observations were made:—

"(1) When the weather is warm and the rain is constantly falling for three days, or the ground is kept moist for the same length of time, with a heavy cloudy sky, the majority of the larvae reach maturity.

"(2) When the weather is warm and dry, as during the period of drought in summer, or dry and sunny, as in winter, practically all the eggs and young larvae in scattered pellets are killed in two or three days, even if amongst ordinary veld grass.

"(3) Concerning variable weather it is not possible to give any definite rule, owing to the action of the ambient being too complex."

"When infected faeces are passed out on to the veld, a fall of rain, even if prolonged for a day at a time, is not sufficient to allow the majority of the larvae to reach maturity, if sunshine is again constant for a few days. It is only during protracted, rainy weather that a large percentage of eggs reach maturity. This fact, connected with the facilities the mature larvae have of reaching the host if the surroundings are moist, explains the heavy infection that is noted in a flock after a heavy rainy season.

"Even in summer the percentage of larvae reaching maturity is very low, but the percentage of eggs deposited in the field is very high. (It was calculated that the number of larvae that would hatch from the faeces of an infected sheep when placed in suitable conditions would attain the daily average of three millions). The sun is the chief agent of destruction for eggs and larvae under natural conditions of the veld and the mortality increases with increased dryness of the soil and atmosphere."

Migration of the Mature Larvae.

Very thorough experiments were performed in this connection; the following are the author's conclusions :—

"(1) The mature larvae of *Haemonchus contortus* crawl on to the grass under favourable conditions of moisture, light and temperature.

"(2) The larvae withdraw to the lower part of the grass or into the ground when the surrounding conditions are unfavourable and re-appear on the grass with the return of the favourable conditions.

"(3) The succession of night and day produces a nocturnal ascent and a diurnal descent of larvae on the grass, provided the conditions of moisture are favourable.

"(4) The period during which a colony of larvae, when not interrupted, performs the ascending and descending migration, was found under artificial conditions to last from 20 to 30 days; it varies within rather wide limits according to a difference of the ambient.

"(5) In the veld, at the end of the migratory period, part of the larvae are found dead or alive on the grass; the majority are found sheltered in the tuft of grass, at various depths in the ground.

"(6) It was repeatedly observed that the larvae in the ground were richest in food granulations and in a better condition of preservation than those on the grass. It appears consequently, that the migratory period results in a natural selection of the species by which weak specimens will soon die from exposure, while the stronger are able to find shelter and resist exhaustion.

"(7) The mature larvae stored in the ground are able to pass the winter season without heavy mortality.

"(8) The presence of larvae in the soil cannot be explained by the penetration of the superficial water alone but is due to 'geotropism of the larvae.'"

Infection.

The direct introduction of mature larvae through the mouth of the sheep is always followed by the presence of parasites in the stomach, and the infection was invariably found to be proportionate to the number of larvae administered. Frequently, mature living larvae were found in the droppings the day following the administration. The result was always negative when lambs were affected with eggs or larvae in the first and second stages.

It was found impossible to infect lambs through the skin although the method employed proved to be effective for other species of larvae.

Parasitic Life.

The period of time required for development from the moment when the larva enters the stomach of the host until it reaches the adult stage seems to be liable to variations owing to influences not yet properly understood, but the average can be estimated to be 15 days.

First parasitic stage (or, *parasitic part of the third stage*).—Larvae introduced into a sheep by means of water reach the abomasum, and here undergo the second ecdysis. The majority of the moulted larvae then take shelter in the mucous membrane of the stomach ; only a few are washed into the intestines. They now begin to feed and are found lodged between the epithelial processes where they shelter without actually piercing the mucous membrane.

The third lethargus is reached from the 30th to the 36th hour after the larvae have gained access to the host and lasts about 12 hours. The larvae in this state are more or less curved, completely immobile and hard to waken.

Second parasitic stage (fourth larval stage).—The growth of the larvae in this stage appears to be very rapid, for shortly after the third ecdysis many larvae are found to reach up to 1 mm. in length. The larva attaches itself to the mucous membrane by means of its buccal aperture, produces a small haemorrhage, and a clot is formed which surrounds the worm. This is observed three days after drenching with mature larvae. The clots are frequent and measure 1 to 2 mm. in diameter. By the sixth day of this stage the sexes can be easily recognised, and on the succeeding days this distinction becomes more and more apparent. On the ninth day the clots have not increased in size or number but are rather flatter, more contracted and darker in colour. The fourth period of lethargus then succeeds.

Adult worm (fifth stage).—The fourth ecdysis takes place between the 9th and 11th days, preceded by a period of lethargus lasting for about 24 hours. The male now measures over 5 mm. by about 90μ in thickness. The mouth cavity is now armed and corresponds in every particular to the mouth of the fully-grown worm. The female measures between 6·5 to 7·9 mm. by from 90 to 130μ in thickness.

On examining the stomach of a sheep 12 days after infection numerous blood clots are present, but they have now become more contracted and of a black colour, adhering to the mucous membrane, whilst petechiae of recent origin are usually found under the clots. These petechiae are caused by the piercing of the mucous membrane by the new mouth apparatus of the larvae, and differ from those previously described inasmuch as they are punctures without any escape of blood. It is rare to find worms outside the clot.

The stomach of a lamb infected 15 days previously still shows in some cases dark red blood clots adhering to the mucous membrane whilst in other cases the clots consist of a residue of yellowish fibrin and ingesta mixed together. In all cases the worms are found in between the clots or distributed on the surface of the mucous membrane itself. Some worms are now found in copulation.

Eighteen days after infection all the clots and fibrin deposits have practically disappeared. In a heavy infestation the mucous membrane is swarming with adult worms. The petechiae are numerous and small, but without any fresh blood clot. Numerous worms are in copulation and numbers of females have laid eggs. The male at this stage measures from 12–13 mm. in length and the female about 17 mm.

Anatomy of the adult worm.—This is described at great length in the original article. The size of the adult worm is given as (1) when collected: male, 15–18 mm., female, 25–29 mm. ; (2) after death: male, 18–21 mm., female, 25–31 mm. ; (3) 48 hours after collection: male, 17–19 mm., female, 23–27 mm.

VELU. **Un cas interessant de cénurose chez la gazelle.** [An interesting case of Caenurosis in a Gazelle.]—*Rec. Méd. Vét.* 1916. Oct. 15. Vol. 92. No. 19. pp. 555–556.

The gazelle in question was brought for examination to the author with a history of a large swelling of the right shoulder accompanied by lameness. It was found on examination that these apparent defects were simply due to a marked inclination of the neck towards the left. The other symptoms and especially the turning movements led to the condition being diagnosed as one of caenurosis. Three weeks later the symptoms were more pronounced, the animal having become affected with epileptiform fits on two occasions, and a small soft tumour about as large as a pigeon's egg was discovered between the roots of the horns.

In the course of an operation for the excision of this tumour an oedematous swelling of the upper eyelid was noticed causing exorbitation of the eyeball. A caenurous sac 40 cc. in capacity was extirpated, but the gazelle subsequently died from cerebral haemorrhage. Post-mortem examination showed that this large sac had caused partial absorption of the cranium, which had become perforated in many places, the two largest perforations being on the forehead and at the bottom of the orbit, respectively.

PIETTRE. **L'onchocercose bovine dans l'Amérique du Sud.** [Bovine Onchocerciasis in South America.]—*Bull. Soc. Cent. Méd. Vét.* 1916. July 6; *Rec. Méd. Vét.* 1916. July 30. Vol. 92. No. 14. pp. 202–203.

This disease is very common in South America as is shown by the following figures obtained in the case of cattle slaughtered for the manufacture of preserved meat.

Argentine Republic.—Frigorifico La Negra: 70 per cent. of the carcases showed marked lesions of the cervical ligament; 25 per cent. centres on the external surface of the great trochanter.

Uruguay.—Frigorifico Uruguaya: 90 per cent. cervical lesions; 18 per cent. trochanteric lesions.

The distribution of Onchocerca is very different from that usually seen in France. The parasite is found more especially on both surfaces of the cervical ligament between the 1st and 5th dorsal vertebrae, and next at the level of the trochanter between the attached fibrous aponeuroses. The lateral ligaments of the femoro-patellar joint are only exceptionally invaded (16 cases out of 1,000 carcases). The numerous specimens of Onchocerca isolated from the cervical ligament possessed a much greater length than those observed in France; the females reached up to 70 cm., although most often one of their extremities was missing. It is supposed that the loose tissue in which these nematodes develop favours their growth, whilst the density of the ligaments of the stifle joint retards it.

The zoological characters appear to be similar to those of the French form. However, the tail of the male showed six papillae grouped together and two widely-separated small ones, whereas only four could be found in a specimen of *Onchocerca gibsoni.*

The lesions provoked are more marked than in French cattle. One observes congested areas with a peripheral oedema, large verminous nodules surrounded by reacting tissue, pockets hollowed out in the inflamed connective tissue and, finally, very numerous encysted purulent centres.

MYCOTIC DISEASES.

(a) EPIZOOTIC LYMPHANGITIS.

AUBRY. **La lymphangite épizootique dans la région de Meknès. Organisation de la lutte.** [Epizootic Lymphangitis in the Meknès Area. Method of Eradication].—*Bull. Soc. Cent. Méd. Vét.* 1916. Nov. 9; *Rec. Méd. Vét.* 1916. Nov. 30. Vol. 92. No. 22. pp. 337–346.

This disease was imported into Western Morocco from Algeria by the army of occupation and made its appearance in the Meknès area in 1911, after the conquest of the town. Its rarity in the country districts three years after the French occupation testifies as to its imported origin. On account of the very bad hygienic conditions, hardships, and saddle injuries which beset the horses and mules, the disease rapidly propagated up to 1915 until all units became contaminated in spite of the equine population being scattered in isolated and widely separated stations.

Unfortunately the veterinary infirmary at Meknès into which affected animals were collected was situated amongst other troops, rendering the propagation of the disease still easier; sanction was finally obtained at the beginning of 1915 for the construction of a lazaret between two high walls 4 kilometres away from the camp.

The majority of affected animals admitted was composed of harness or pack animals, that is, animals bearing harness sores. In spite of the prophylactic and therapeutic measures adopted the number of cases exceeded 100 at the commencement of 1915, fell down to 10 at the end of the year, and rose up again to 70 during the winter 1915–1916 during the rainy season. Five animals remained under treatment at the end of the summer of 1916, moreover affected only with sores of limited size.

The following résumé shows the number of animals dealt with at the lazaret :—

Year.	Admitted.	Died.	Destroyed.	Cured.
1914	259	4	50	205
1915	412	2	89	321
1916 (to 10th Aug.)	95	4	11	80
Total	766	160		606

The economic aspect of the disease thus assumes considerable importance both on account of the losses involved by death and destruction and by the cost of upkeep and loss of utility of the animals during the period of infection. The author deals only with the military effectives in this article but the losses among civilian animals have become serious, especially in the country districts. In eradicating the disease he thus aims at (1) the destruction of actual centres, and (2) guarding against infection of civilian effectives, on which it would be very difficult to take action in a native environment.

Diagnosis of the disease.—The author believes that by means of a simple clinical examination the disease can be easily differentiated from glanders and this is important as in most cases a microscope would not be accessible to the practitioner. Under the low power of the microscope the cryptococcus is easily discernible.

Prophylaxis.—Under the conditions which obtain in the field in Morocco this is very difficult and the part played by the veterinary surgeon of a column or of an outpost consists in eliminating affected animals and transferring them to the rear; during this time the cryptococcus multiplies in the sores and is liable to infect other animals en route. The veterinary surgeon in charge of the intermediate post has greater facilities on account of his fixed position.

Nine times out of ten contagion is brought about through harness wounds and these become infected with the cryptococcus, living in moist earth and dung, by means of contact with harness, earth, flies and personnel in charge. The effect of earth is shown by the number of mules affected especially during the rainy season, as these animals are accustomed to roll on the ground.

The author insists upon the necessity of educating all ranks upon the nature of the disease and accordingly he formulates a list of instructions to be followed by them.

With regard to curative treatment the results enumerated above were obtained by adopting the following measures :—

(1) By the installation of a lazaret.

(2) By the simplest surgical measures, after having tried different more or less difficult and costly treatments. The procedure employed is as follows :—(*a*) Wide opening of abscesses, buds, or corded lymphatics, (*b*) extirpation of affected glands and corded lymphatics if possible, (*c*) washing absolutely forbidden.

The wound is dried (the cotton wool is then burned) and sprinkled with pure powdered potassium permanganate or any other strong powder.

In discussing this paper BRIDRÉ notes that the results obtained by Aubry appear satisfactory, but that they might be still more so if internal treatment had been administered in certain cases. As an example he refers to an extremely severe inoperable case which received potassium iodide daily in its drinking water according to CARTIER'S method and three injections of novarsenobenzol. The treatment lasted four months but the horse was cured and treatment appeared justified on the account of the value of the animal. Cases should not be considered incurable because they are inoperable. The economic aspect should be considered in each case before adopting a line of treatment.

CARTIER (J.). **Note sur le traitement de la lymphangite épizootique par l'iodure de potassium.** [Treatment of Epizootic Lymphangitis by means of Potassium Iodide.]—*Rec. Méd. Vét.* 1916. Nov. 15. Vol. 92. No. 21. pp. 614–618.

In the treatment of epizootic lymphangitis, potassium iodide was administered intravenously by TRYPAZ, but his method appears inconvenient on account of the necessity of frequently repeated injections and of the introduction of a chemical agent of a great diffusibility into the blood.

The author himself introduces the drug by means of the digestive tract, although this simple method seems to have been abandoned on account of the failures recorded. The potassium iodide should be administered in large doses ; from 12 to 20 grammes were administered daily without the appearance of any toxic symptoms. The tolerance of the patient is first tested by means of a relatively large dose, 12 to 14 grammes for example, and the attainment, as rapidly as possible, of the maximum tolerated curative dose is recommended. On account of its diffusibility the administration of the drug at least twice a day is also advised ; a 10 per cent. solution, for example, is given in a small mash before each feed. The treatment need not be continuous, and it is advantageous to interpose periods of rest.

The author then details a series of seven observations made in the treatment of more or less advanced cases of epizootic lymphangitis. Cures were obtained in all cases in from about one up to three months.

[The expense of this treatment appears to be a considerable obstacle to its general adoption.—Ed.]

CHAPRON (H.). **Observations relatives à l'incubation de la lymphangite épizootique.** [Incubation Period of Epizootic Lymphangitis.]—*Bull. Soc. Cent. Méd. Vét.* 1916. Dec. 7; *Rec. Méd. Vét.* 1916. Dec. Vol. 92. No. 24. pp. 402–404.

This short article gives a history of four cases of epizootic lymphangitis occurring in horses which have been issued, each to different units in the French Army, from a depot at a certain date. As these horses must have contracted the disease before they were issued to the units the period of incubation under natural conditions could be easily calculated, and this was 80, 84, 112, and 121 days, respectively, for the four animals. These figures confirm the results of experimental inoculation, by means of which the incubation period had previously been shown to be very long.

NICOLAS (E.). **La lymphangite épizootique en France. Son traitement par la méthode Chatelain et sa prophylaxie.** [Epizootic Lymphangitis in France. Treatment by Chatelain's Method and Prophylaxis.]—*Bull. Soc. Cent. Méd. Vét.* 1916. Nov. 9. *Rec. Méd. Vét.* 1916. Nov. 30. Vol. 92. No. 22. pp. 334–337.

This treatment, which consists essentially in the local application of copper sulphate deserves, in the author's opinion, to be made more extensively known on account of the facility with which it can be applied in the field, and on account of the very good results obtained. The procedure is (*a*) open the buds and abscesses by means of a cautery, evacuate the pus, and insert into each puncture a crystal of copper sulphate proportional to the size of the lesion (usually about the size of a pea) ; (*b*) around the infected area inject 5 cc. of an iodine solution (tincture of iodine, 2 ; water, 8 ; potassium iodide, qs.) by means of a hypodermic syringe.

In the author's experience the second part of the treatment is liable to produce considerable swelling and he substitutes for it the following: (*c*) along an excentric line around the infected area and 10 cm. from it a series of punctures, 10 cm. apart, is made by means of a cautery, and a small crystal of copper sulphate is inserted into each puncture. The affection then remains localised, the buds are reabsorbed, abscesses cicatrise, and corded lymphatics disappear. The affected animals should be carefully observed so that if necessary ulcers which are slow in healing may be cauterised again with copper sulphate and new buds treated as soon as they are formed.

With regard to prophylaxis the author enumerates points dealing with strict isolation, the necessity of using fresh swabs for each ulcer, and the avoidance of dressings. Under field conditions in France all cases of ulcerative lymphangitis should be considered epizootic, and treated as such.

The author refers to the parasite of the disease as *Leucocytozoon piroplasmoides*, a name given to it by DUCLOUX in 1908.

BRIDRÉ, in discussing this communication, refers to the work which has since been done to show that this name is incorrect inasmuch as it is not a Protozoon but a vegetable parasite closely related to the Blastomycetes.

SOCIÉTÉ DE PATHOLOGIE COMPARÉE. 1916. Oct. 10 & Nov. 14.—[Epizootic Lymphangitis.]—Reports extracted in *Rev. Gén. Méd. Vét.* 1916. Dec. 15. & 1917. Jan. 15. Vols. 25 & 26. Nos. 300 & 301. pp. 632–636 & 39–40, respectively.

In two sittings of the above society papers were read and discussions took place on epizootic lymphangitis; the main points are extracted below.

CHENIER, in his paper, states that formerly this disease was generally considered as a cutaneous form of glanders, and accounted for each year (in France) from 200 to 300 victims. For the last thirty years it had almost completely disappeared; only a few rare cases were still observed in the French African possessions. It has been re-introduced into France probably by means of horses from Algeria, and, at the present moment hundreds of cases of it occur. Attempts at intensive therapeutic treatment have been made. BRIDRÉ, of the Pasteur Institute, has employed novarsenobenzol, others have had recourse to galyl and potassium iodide. The results are not yet conclusive. Whilst recognising the value of researches made in this direction Chenier, formerly a military veterinary surgeon, to whom we owe the differentiation of glanders from epizootic lymphangitis, as well as the determination of the mode of transmission of the latter disease, believes that it would be unwise completely to abandon cauterisation of abscesses by means of the hot iron, a method of treatment which has been thoroughly tested.

In discussing this paper PETIT (A.) states that out of more than 200 cases met with in Morocco he never observed contagion to take place by means of immediate contact. In several cases in which the lesions first affected the eyes, he found the dead bodies of flies in the folds of the conjunctiva, and hence thought that the fly acts as a vector of the disease. He never saw the lesions extend beyond the deeper layers of the dermis.

Surgical treatment with the excision of the corded lymphatics seemed to expose the patients to relapses, either by external re-infection or by omitting to excise the whole of the infected tissue; moreover, cicatrisation is slow and often defective. In order to obtain the largest number of cures in the shortest period of time he thus adopted a treatment consisting in (1) application of a blister, (2) puncturing if necessary, (3) disinfecting the opened abscesses by means of a non-irritating antiseptic.

Curetting favours re-infection and is not recommended. Mercurial blister was even applied over the borders of the eyelids and produced only a temporary inflammation.

The disease appeared to be more severe in the district of Casablanca, with a moist climate, than in the district of Marrakech, a dry country.

Fayet and Bonnel in their paper now disclaim having successfully cultivated the causal organism; the mould resembling Rivolta's cryptococcus which they claimed in a previous communication to have cultivated was in reality a saprophyte from outside sources. Attempts at cultivation from further cases on glycerinised potato have remained negative.

Bridré, in discussing a point raised by Brocq-Rousseu, adduces facts which all workers who have studied the disease hold to incriminate the cryptococcus as the sole cause of infection.

Bilhaut uses chloride of zinc for the suppurative lesions, or other agents such as petrol.

Bridré states that intravenous injections of novarsenobenzol appear remarkably efficacious if administered in sufficient doses, that is, three grammes per horse. The good results claimed to have been obtained by Cartier following the administration of large doses of potassium iodide by ingestion were also corroborated by him.

Chenier believes that while the newer methods of treatment are advisable in some cases one should not be induced to slaughter cases that could be easily cured by the older methods of treatment.

Epizootic lymphangitis with ulcerative lesions of the pituitary mucous membrane.—Cazalbou and Morel (G.) state that glanders even in its clinical form may be mistaken for epizootic lymphangitis, when no reaction follows the mallein test. There exist, however, symptoms characteristic of epizootic lymphangitis but, as it happens, still badly understood.

Whereas it is not very serious to confuse ulcerative lymphangitis with cryptococcic lymphangitis it is far more so to assign Rivolta's lymphangitis to glanders, for in the latter case, one treats a glanderous animal. It would be advisable that special attention should be drawn to those cases labelled epizootic lymphangitis with ulcers of the nasal mucous membrane, in order that the animals might be examined as closely as possible.

Olver states that in the Sudan and in India he observed many cases of lymphangitis with nasal lesions and it was very difficult to differentiate them from glanders. The disease in these countries is very serious and the very numerous flies appear to play a part in its spread, as they were found in the canthus of the eyes of affected animals. In South Africa no nasal lesions were observed in the numerous cases of lymphangitis encountered.

Cases in which pulmonary lesions occurred were mentioned by BRIDRÉ, the first having been published in 1912. In view of the fact that the rôle of flies has been much discussed this observer notes, however, that the disease is especially common in winter during the wet season, which is precisely the season in which flies are least numerous.

In the Sudan, OLVER also noted that it was during the wet season that cases were most frequent, but the long period of incubation must be taken into account. In any case it is certain that the infection can be transmitted by means of dressings, and it is possible that a fly may carry the virus in the same manner from an affected to a sound animal.

JACOULET quotes TEPPAZ who studied epizootic lymphangitis in Senegal, where the natives consider it as a disease of districts infested with flies and appearing when the animals come down into the marshy bush country, and disappearing of its own accord when the animals return to the wind-swept uplands not very favourable to the flies. It is also remarked that these hot moist regions are, as well as being infested with flies, also well suited to a cryptogam flora. However, as evidence against the theory of fly transmission it has been brought forward that the disease occurs more especially during the season when they are very little seen. With these facts in view one must, however, take it into account, firstly, that the period of incubation varies from 60 to 125 days, and of the fact that in Oran, for example, there is hardly any time of the year in which flies are not seen and that it is during these intermediate rainy seasons that they are most tenacious.

JACOULET also refers to a communication of PETIT (A.) who argued that in several cases where the infection first involved the eyes, and the bodies of dead flies were found in the folds of the conjunctiva, the fly should be considered as the principal propagating agent. PETIT was here probably confused for further on he states that he has never seen the disease extend beyond the depth of the dermis whilst in reality the lesions are generally deeper and are seated in the lymphatic system.

As appears to result from the work of CAZALBOU and MOREL it is urgent to avoid all confusion until one has by all means arrived at a diagnosis and eliminated glanders. As regards the invasion of the body cavities it is rare, but still possible, and cases have been published by him (Jacoulet).

In the matter of surgical intervention associated with internal treatment everybody is in agreement with CHENIER.

VELU. **La lymphangite épizootique (Localisation.—Durée d'évolution.).** [Epizootic Lymphangitis. Seats of the Disease and Period of Evolution.]—*Bull. Soc. Cent. Méd. Vét.* 1916. Dec. 7; *Rev. Méd. Vét.* 1916. Dec. Vol. 92. No. 24, pp. 385–388. With 3 tables.

Between May 1913 and April 1915 the author treated 300 animals affected with epizootic lymphangitis at the veterinary infirmary at Casablanca. A careful account was taken of each case and various methods and products were employed in the treatment. In order to appreciate the results it was thought necessary to study the course of the disease according to the seat affected ; for example, one might learn that lesions affecting the neck are relatively mild and run their course in six weeks no matter what treatment is adopted. The seats affected, the extension of the lesions, the length of treatment and average duration of the disease in the case of the various seats, are enumerated in the tables.

In 113 cases (or 37·6 per cent.) the disease developed on the trunk as the result of harness sores, and generally the corded lymphatics emanating from the affected wounds were directed towards the entrance to the chest; exceptionally (2·33 per cent.) they gained access to the precrural gland.

Lesions on the limbs represented only 19·33 per cent. of the cases treated. The hind limb was more often affected (35 cases) than the fore limb (23 cases). Invasion of the upper parts of the limbs was more frequent than extension along the whole limb (23 cases as against 12 for the hind, 18 as against 5 for the fore limbs).

The head was fairly often affected (16 per cent.), then came localisations on the shoulder (11·6 per cent.) and on the breast (7 per cent.). Neck lesions are rare (2·66 per cent.), as well as those of the lumbar region (2·66 per cent.), and genital organs (2·66 per cent.).

Lesions of the mucous membranes (sheath, vulva, nasal, conjunctival) remained the most refractory to treatment. All the animals recovered, but the average duration of treatment reached or exceeded four months.

Lesions of the withers are equally serious, inasmuch as they often involve the bony tissue and become complicated with chronic suppurations which evolve in about four months or necessitate destruction.

Localisations on the limbs were curable rather more quickly—in from three to four months on an average. Lesions affecting the hind limb are in fact more difficult to cure than those of the fore limb. The disease affecting the lumbar region, breast, and shoulder is less severe than that of the limbs, back, or sides, since it runs its course in less than three months.

Finally, localisations of the head (cutaneous) and neck are comparatively benign, since a cure can be brought about as a rule in six weeks.

(b) SPOROTRICHOSIS.

DAVIS (D. J.). **The Permeability of the Gastro-Intestinal Wall to Infection with** *Sporothrix schenckii.*—*Jl. Infect. Dis.* 1916. Nov. Vol. 19. No. 5. pp. 688–693.

In this article an account is first given of the literature dealing with the permeability of the mucous membrane of the gastro-intestinal tract to organisms of various kinds. The permeability of the mucous membrane to sporothrix organisms was investigated by feeding rats with cultures of typical *Sporothrix schenckii* isolated from the human subject, rats being highly susceptible to experimental inoculation. The cultures were ground up in a mortar and mixed with milk.

Tests were made to determine the length of time the Sporothrix remained alive in the stomach of the rat. At the end of two hours after ingestion the organisms could be seen and readily recovered by culture. At the end of three hours they could usually be recovered. At the end of four hours, in the case of four rats, the author could not detect the organisms in smear or in culture.

A number of animals died within a short period of time following the feeding; examination of the heart blood and other body fluids in these cases did not reveal any Sporothrix organisms. The history of 13 animals fed regularly over a period of several weeks or months is tabulated. It appears that only two of these animals showed on post-mortem examination distinct lesions of sporothricosis, as evidenced by nodules in the omentum, mesentery, and lymphatic glands. The organisms fed in these experiments had been previously shown to be highly virulent for rats by subcutaneous or intra-peritoneal inoculation.

The author quotes GOUGEROT, who fed rats and young guinea-pigs with cultures of *Sporothrix beurmanni.* Two rats were fed with large amounts of such cultures for six months; both animals became infected and after ten months one died and the other was killed; extensive sporothricotic lesions were found in both.

The author's summary is as follows:—

"White rats fed at intervals of a few days with large quantities of cultures of *Sporothrix schenckii* may become infected.

"The infection tends to localise in the mesentery, peritoneum, and spleen.

"The organisms appear to penetrate the normal mucosa of the intestinal tract. No lesions active or healed were visible in the mucosa or in the wall of the stomach or intestines."

MEYER (K. F.). **Notes on the Occurrence of Equine Sporotrichosis in Montana and the "Blastomycotic" Form of** *Sporotrichum schencki-beurmanni.*—*Proc. Soc. Exper. Biol. & Med.* 1916. Oct. 18. Vol. 14. No. 1. pp. 23–24.

"In 1915 I expressed the belief, based on very inadequate material, that animal sporotrichosis is found also in Montana. Quite recently, through the courtesy of Doctor Du Frene, of Glendive, fresh pus collected from a case of equine sporotrichosis was forwarded to me for diagnosis. Without the least difficulty a typical *Sporothrix schenki-beurmanni* was isolated on Sabouraud medium, and conclusive bacteriologic evidence was thereby obtained that sporotrichosis exists endemically in Montana.

"As is customary in our studies on fungi, plain one per cent. glucose agar was inoculated with the pus. The growth on this medium remained perfectly white and thin, becoming thick, moist, very stringy and inelastic in contrast to the typical well-pigmented folded film observed on Sabouraud's agar. The culture did not penetrate into the superficial layers of the agar, and was easily emulsified. It grew well under anaerobic conditions, and produced a rapid septicaemia in rats and rabbits. On one per cent. glucose agar and plain potato, this pleomorphism has remained so far (three weeks and four transplants) constant, but on Sabouraud medium the typical growth invariably appeared in a short time.

"Microscopically, such a culture consists of oblong, oval or round, short, monilia-like mycelia with a well-marked double membrane and refractile granules. Some round forms show reproduction by budding and aggregations in pairs or short chains. Long mycelia with typical clusters of spores were always absent. Macroscopically and microscopically these cultures appeared in every respect like yeast or saccharomyces.

"The 'blastomycotic' pleomorphism has been observed by Gougerot for the *Sporotrichum beurmanni*, but has never been described for the American strains. When transplanted on very moist and soft agar, I repeatedly noticed, for at least three to four days, the yeast-like character of some human strains isolated from cases in North America, but such cultures always returned to the typical growth within ten days.

"The tendency of a recently isolated strain of sporothrix to revert to its parasitic pleomorphism under unfavourable conditions (moisture, absence of oxygen, and carbohydrates) appears to be characteristic of the European as well as of the American types, and clearly proves their close botanical relationship with the 'blastomyces.'

"Serologic tests have previously shown that complement fixation is regularly obtained with sera of infected or immunised animals when various yeasts are used as antigens."

BACTERIAL DISEASES.

DOLD (Hermann). **Vier weitere Fälle von natürlich erworbener bazillärer Dysenterie beim Hunde, nebst Beobachtungen über Bazillenträgertum.** [Four Further Cases of Naturally Occurring Bacillary Dysentery in the Dog, with Observations on the Carrier Problem.]—*Deutsche Med. Woch.* 1916. July 6. Vol. 42. No. 27. pp. 811–813.

In 1915 the author and FISCHER (W.) published the first confirmed case of bacillary dysentery in the dog. This occurred in a sporting dog kept in the neighbourhood of Shanghai and worked over ground where multiple opportunities for infection from human faeces arose owing to the lack of hygienic conditions among the natives. According to the sportsmen of the district dogs often passed mucous, blood-stained faeces in these parts.

Out of seven dogs, brought to the author for examination affected with diarrhoea, four were found to be infected with dysentery bacilli. A record of each of these cases is given, containing a history of the course of the disease, including the condition of the faeces; the results shown were obtained by microscopic examination of the faeces, cultivation on Endo plates, from the characters of growth of suspected colonies in the various test media, and from the agglutination titers of the strains obtained from each case against each of three different known agglutinating dysentery sera (Flexner, Shiga-Kruse, and Y, respectively). No opportunities for post-mortem examination occurred as the animals were taken back by their owners, and three out of the four affected cases recovered.

It was found that the four dogs affected with clinical symptoms of dysentery on bacteriological examination gave the following results:—

Case 1. Dysentery bacilli (Flexner type) and rare, not regularly found, amoebae and flagellates.

Case 2. Dysentery bacilli (Y type) and amoebae.

Case 3. Dysentery bacilli (Flexner type) and eggs of *Schistosomum japonicum.*

Case 4. Dysentery bacilli (Shiga-Kruse type).

The various types of dysentery bacilli were further tested as to their respective virulence by rabbit inoculation. In all four cases the serum of the dogs gave a distinct agglutination reaction against the respective types isolated from the faeces or from the blood (1 : 300, 1 : 100, 1 : 300, and 1 : 120, respectively).

"Case 4 was a pure bacillary dysentery as well as Case 3, for the *Schistosomum japonicum* could hardly have contributed towards the clinical symptoms. In Case 1 the amoebae, the pathogenicity of which was not determined, apparently were only of subsidiary importance inasmuch as they were very few in number and not always present in the faeces. In Case 2, in which the amoebae were numerous and constant, a mixed infection was possible; while the importance of the amoebae was not known the importance of the bacilli was apparent on account of the specific immune reaction of the serum of the infected animal."

The author next infected a healthy animal, the faeces of which were free from dysentery bacilli, with a culture of dysentery bacilli (Strain Y) by feeding. No clinical symptoms followed and the faeces of the dog remained normal in consistence, but dysentery bacilli could be isolated from them for a period extending over three months.

In order to determine the persistence of dysentery bacilli in the mouth and especially on the tongue a dog which had swallowed the bacilli was caused to lick Endo plates daily. It was found that dysentery bacilli could be isolated from the tongue for a period extending up to 13 days after infection.

VAN SACEGHEM (R.). **Etude sur des cas de dermite ulcéreuse des Equidés observés au Congo Belge.** [Ulcerative Dermatitis of Equines in the Belgian Congo.]—*Bull. Soc. Path. Exot.* 1916. Nov. Vol. 9. No. 9. pp. 675–679.

Several cases of specific ulcerative dermatitis were observed by the author especially amongst asses. Horses were equally susceptible but the lesions never assumed the pernicious character they did in the case of the donkey. The disease affected African as well as European breeds of asses.

A detailed account of three cases is given in which the lesions affected the breast, the knee, and the right side of the chest respectively. The last described ass also gave birth to a young animal which soon succumbed to the disease.

The lesions consisted of an ulceration of the skin, a necrosis of the underlying tissues with the formation of numerous fistulae, together with the presence around the ulcer of small very firm tumours which on section disclosed a characteristic oily pus. The disease remained quite refractory to treatment.

Clinically the disease resembled epizootic lymphangitis, but no cryptococci could be discovered in the pus. Glanders was eliminated by the mallein test. The bacillus of Preisz-Nocard could not be discovered and inoculation of virulent pus into sheep gave negative results. Smears from the oily pus of the lesions always showed the presence of small cocci, 0·5 microns in diameter, in the form of diplococci, or in masses, or in short chains. The organism grew well on serum in the form of short-chained streptococci.

Inoculation into guinea-pigs produced a firm swelling which later suppurated. A culture killed by heat injected into an affected ass produced a thermic reaction together with a marked local reaction. The author proposes the name *Dermatococcus congolensis* for this micrococcus.

In discussing this paper, BRIDRÉ mentions that in several cases of ulcerative lymphangitis in France he has been able to find a small Gram-negative micrococcus in a pure state, free or included in the leucocytes, in pus taken from unopened abscesses. He also notes that in the disease attributed to the Preisz-Nocard bacillus this bacillus was not found by NOCARD in all the horses he examined. In BRIDRÉ's cases the lesions always affected the hind limb, contrary to the dermatitis observed in the Congo asses by Van Saceghem.

DISEASES DUE TO ULTRA-VISIBLE VIRUSES.

(a) Foot and Mouth Disease.

Kallert (E.). **Untersuchungen über Maul- und Klauenseuche. IV. Mitteilung. Die bei Maul-und Klauenseuche im Pansen des Rindes auftretenden Veränderungen.** [Lesions in the Rumen of Cattle affected with Foot-and-Mouth Disease.]—*Arbeit. a. d. Kais. Gesundh.* 1915. Dec. Vol. 50. No. 2. pp. 159–163. With 2 plates (1 coloured) comprising 7 figs.

The importance of lesions produced in the rumen of cattle in foot-and-mouth disease is masked by the more obvious external lesions; on account of the possibility of secondary infection by absorption of bacteria and toxins from the decomposing contents of the rumen these changes, however, have a considerable influence on the course of the disease.

Naked-eye examination of the lesions reveals the presence of aphthae or blisters lying side by side in various stages of development. The smallest consist of brownish-red or dark-red slightly raised specks about the size of pins' heads; these increase in size until one sees irregular, raised, rounded or oval areas about ½ cm. in diameter. Transverse section shows that the raising of these patches is due to a marked exudation of blood between the layers of the epithelium.

Further changes consist in the shedding of the upper layer of the blister and this is probably soon effected owing to the movements of the stomach contents. The blood clot in the blister cavity is then removed showing the base of the blister, which is of a light-red or grey colour.

The most extensive formation of blisters takes place on the membrane covering the pillars of the rumen while none may be found in the region of the long papillae. The development of the aphthae must take place rapidly as all stages are found in animals slaughtered while suffering from the disease. It is presumed that healing takes place in the same manner as in the case of the skin lesions.

Microscopic alterations.—The author gives a description of the histology of the normal rumen epithelium. The commencing changes appear to take place by the rupture of the capillaries embedded in the papillae of the lamina propria or connective tissue layer. The extravasated blood appears to traverse through the deepest epithelial layer (stratum cylindricum) and infiltrate the next layer (stratum spinosum), which thus becomes destroyed and replaced with blood mixed with strands of epithelium.

This early haemorrhagic infiltration is therefore comparable to what one commonly finds in inflammatory diseases involving any part of the mucous membrane of the digestive tract.

The upper horny layer (stratum corneum) together with the underlying cellular detritus is soon lost through the mechanical action of the rumen contents. The base of the small ulcer is thus formed almost entirely from the connective tissue papillae, still covered with remnants of the destroyed epithelium, the layer of cylindrical epithelial cells (stratum cylindricum) showing a marked persistency.

Instead of being sharply circumscribed as in the case of the skin aphthae, the rumen lesions show another peculiarity in that while they are still intact the contained cellular detritus tends to infiltrate for some distance around and in between the layers of intact epithelium.

The author concludes that in foot-and-mouth disease the changes occurring in the rumen of cattle comprise typical blisters or aphthae which differ macroscopically and microscopically from the aphthae appearing on other parts of the body in a few particulars, especially in an influx of blood into the aphthae and an early loss of the covering epithelium.

(b) FOWL POX.

GALLAGHER (B.). **Epithelioma contagiosum of Quail.**—*Jl. Amer. Vet. Med. Assoc.* 1916. Dec. Vol. 3. No. 3. pp. 366–369.

Epithelioma contagiosum (avium) or bird pox is stated to have been shown by recent investigators to be identical with avian diphtheria, the causal organism being capable of producing either the hyperplastic epithelial nodules characteristic of the former, or the croupous and diphtheritic pseudo-membranes on the mucous membranes of the head associated with the latter disease.

The outbreak observed by the author occurred in live quail which are imported in large numbers from Mexico into the United States for the stocking of game preserves. Four hundred birds were under observation and the mortality during a period of five weeks amounted to 85 per cent. The symptoms and lesions exhibited by affected birds consisted, in some cases, in the eyes only becoming infected ; in others, the diphtheritic exudate was found in the nasal passages and in the mouth. Most of the birds showed typical bird pox lesions on the skin especially of the wings and around the head, which had become more or less ulcerated during transit in crates. In many cases all lesions mentioned were present on one individual.

Transmission experiments.—In one series of experiments emulsions made from the quail pox nodules and also quail diphtheritic material from the mouth were spread on the lightly scarified surfaces of the combs and wattles of young fowls. In each case characteristic pox nodules developed at the points of inoculation after a period of 6–8 days. The lesions were, however, not so marked as those produced by artificial inoculation of chicken pox from fowl to fowl.

After rubbing the emulsions on to the oral mucous membranes, lightly scarified, of half grown fowls typical croupous patches appeared in seven days.

Two fowls inoculated intravenously with emulsion remained unaffected.

Experiments to determine whether the disease was produced by a filterable virus apparently all gave negative results.

(c) RINDERPEST.

BOYNTON (W. H.). **Rinderpest in Swine, with Experiments upon the Transmission from Cattle and Carabaos to Swine and Vice Versa.** —*Philippine Agric. Rev.* 1916. Fourth Quarter. Vol. 9. No. 4. pp. 288–336. With 2 plates and 10 charts. 1916. Manila. Bureau of Printing.

While working on rinderpest in the field in the Philippine Islands it had been noticed for many years that simultaneously with the appearance of the disease in cattle and carabao in certain localities pigs also became affected. Evidence that pigs played a rôle in the spread of rinderpest was especially brought forth in the course of an investigation into an outbreak of the disease causing serious losses among cattle in the island of Romblon, where previously the disease had never existed, and no cattle had been imported there for a long time; it was found, however, that pigs had been imported from another island where rinderpest was prevalent and that first of all the pigs died in considerable numbers before the cattle and carabao began to die in a village.

Hitherto the disease had been overlooked in pigs as, owing to the prevalence of swine fever and other infestations, an unthrifty condition among pigs was very prevalent throughout the islands.

Pigs which had been hyperimmunised against swine fever in the laboratory in 1914, when exposed to cattle sick with rinderpest each developed symptoms similar to those caused by the disease in cattle.

Reference is made to the scanty and contradictory literature on the subject. CARRÉ and FREIMBAULT (1898), in Indo-China, demonstrated the possibility of transmitting rinderpest from pig to pig by contact and by blood inoculation, and also from bull to pig and from pig to bull by blood inoculation. LEBLANC (1886) found rinderpest among peccaries, and PENNING claimed to have transmitted the disease to wild boar. PLUNING noticed rinderpest in swine in Sumatra. THEILER claimed to have transmitted rinderpest to swine by inoculation of blood from cattle affected with rinderpest. JOBLING (1903), in the course of an experiment upon rinderpest in the Philippine Islands, inoculated a pig with 5 cc. of virulent rinderpest blood from a bull; the pig developed typical symptoms of rinderpest; a pig inoculated with blood from this pig did not develop symptoms of the disease, whereas a bull inoculated with the same blood developed typical symptoms of rinderpest, but ran a mild course of the disease, and on slaughter lesions of rinderpest were noticed.

The author then details a long series of experiments upon the transmissibility of rinderpest.

(1) The first series, in which pigs were exposed to cattle sick with rinderpest, consists of ten separate experiments. The pigs were exposed in two small stalls, the sick cattle being tied in these stalls while the pigs were unrestrained during the exposures. All the pigs used in the experiment had been kept in quarantine for a certain length of time, varying from 20 up to 76 days, their temperatures being taken twice a day and their daily physical condition noted. A history of the affected bulls is included in each experiment as well as the known history of each pig prior to the experiment.

It was found that all the pigs after exposure contracted a disease and developed symptoms characteristic of rinderpest in cattle and carabao. Three of the animals developed their initial rise of temperature on the 3rd day, four on the 4th day, one on the 7th day, one on the 8th day, and one on the 9th day of exposure. The incubative period of the disease in pigs thus corresponded very closely to that in cattle and carabao, in which it varies between 3 and 10 days.

Of the pigs used two died, four recovered but remained unthrifty and were killed, although under normal conditions these animals would undoubtedly have been allowed to live, and of these four one contracted swine fever. Three presented very mild symptoms, showing only a temperature reaction and recovering rapidly; these animals under field conditions would hardly have been suspected of being sick. One was bled to death for virulent blood, thus making the natural result uncertain.

The above ten pigs were exposed altogether to 19 cattle affected with rinderpest. Of these 19 cattle 14 died of rinderpest, three recovered, and two were bled to death for virulent blood, thus making uncertain the natural outcome of the disease.

The mortality among the cattle in these experiments was accordingly 73·7 per cent., as against 20 per cent. in pigs.

(2) In the second series, consisting of three experiments, pigs which had been kept in quarantine for a certain length of time were exposed to pigs affected with the disease contracted from cattle affected with rinderpest. Two of the animals developed a rise of temperature on the 4th day after initial exposure and one on the 5th day; two died and one recovered but was finally destroyed on account of its unthriftiness. The mortality in pigs exposed to rinderpest-affected pigs thus appears higher than that of pigs exposed to rinderpest-affected cattle.

(3) In the next experiment rinderpest is shown to have been transmitted from pig to pig by means of a caretaker. The author had previously shown that in the case of cattle and carabao the virus of rinderpest was in such a condition that it was unable to cause the disease after a corral had been freed from sick animals for 24 hours. The pig used in this experiment was put in a corral in which there had been placed ten days previously two pigs that had died of rinderpest and had also shown lesions of swine fever on post-mortem examination. The pig thus exposed did not contract rinderpest, but developed a rise in temperature and showed mild symptoms which were diagnosed as those of swine fever. Three weeks later two pigs showing acute symptoms of rinderpest which terminated in death were placed in a corral 50 yards away from this pig and looked after by the same caretaker. Nine days later the pig showed a rise in temperature and died four days afterwards showing typical lesions of rinderpest on post-mortem examination.

(4) In the next series of experiments two pigs were inoculated with virulent blood from two pigs affected with rinderpest. The first pig was inoculated with 10 cc. of virulent blood and showed a rise of temperature on the 3rd day and died on the 4th day without showing any marked lesions. The second pig was inoculated with 2 cc. of virulent blood from another rinderpest affected pig and showed an initial rise of temperature on the 3rd day and on the following days showed loss of appetite and diarrhoea, and then gradually recovered, but remained unthrifty; the disease is stated to have run a typical course of rinderpest.

(5) In the following series of experiments pigs were inoculated with virulent blood from cattle affected with rinderpest. Four pigs were thus inoculated with blood from four bulls respectively, the history of which is outlined in each experiment. Both the pigs used in the first two experiments after an incubation period of three days ran a severe course of the disease and died presenting typical lesions of rinderpest on post-mortem examination. The other two pigs did not contract rinderpest and it is concluded that as they were known to have shown

a high temperature and developed diarrhoea prior to being used in these experiments they had been rendered immune by means of a previous mild attack of rinderpest.

(6) In another experiment a quarantined pig was inoculated with a mixture of virulent blood from a bull and a pig, both affected with rinderpest. The inoculated pig developed a rise of temperature three days later and died on the 20th day, presenting well-marked lesions of rinderpest on post-mortem examination.

(7) A known non-infected pig was drenched with 50 cc. of virulent blood from a carabao. Four days later it showed a rise of temperature and on the 6th day it was bled to death for virulent blood to be used in immunisation work.

(8) A series of six experiments were next performed in order to demonstrate the transmission of rinderpest to cattle by exposure to affected pigs. The results of these experiments are not altogether conclusive.

In the first experiment a quarantined bull was placed in the same corral as two rinderpest-affected pigs for 15 and 12 days respectively; the bull remained unaffected. Inoculated later with virulent blood from a bull it died from rinderpest as the result of the inoculation.

In the second experiment a bull placed with an affected pig also failed to contract the disease but subsequently remained unaffected as the result of inoculation with virulent bovine blood.

In the third experiment a bull was placed in the same corral as two rinderpest-affected pigs for 16 and 11 days respectively; the bull remained unaffected. The bull was later proved to have been susceptible during the exposure as it contracted rinderpest when inoculated with virulent bovine blood.

In the fourth experiment a bull, previously kept under observation for 332 days, was exposed to infection from two pigs directly and one pig indirectly by means of a caretaker. These pigs all showed acute symptoms and died later, showing typical lesions of rinderpest. The exposure in each case lasted one, nine, and five days, respectively, or fourteen days from beginning to end. Two days after the end of the exposure the bull commenced to manifest symptoms which became subacute in character, until the animal died 23 days later, showing typical lesions of rinderpest on post-mortem examination.

In the fifth experiment a bull was exposed for four days to a pig showing subacute symptoms of rinderpest from which it later recovered; the bull remained healthy but was proved afterwards to have been susceptible by inoculation with virulent bovine blood.

In the sixth experiment a cow placed for four days in the same stall as an infected pig showed a rise of temperature six days after the first exposure, later developed typical symptoms of rinderpest, and was bled to death on the 10th day for virulent blood.

(9) In a series of four experiments cattle were inoculated with blood from pigs affected with rinderpest. All except one readily contracted the disease, the failure being noted in the case of a bull which was inoculated with only 0·5 cc. of blood. It is admitted that a much smaller quantity has been demonstrated to transmit the disease when virulent blood is taken from a sick bull.

(10) In another experiment it was shown that the potency of the virulent blood is not materially affected by mixing pig and cattle blood.

(11) Two experiments were performed in which cattle were drenched with urine from affected pigs. In one experiment a bull drenched with freshly collected urine contracted the disease, while the result was negative in the case of the other animal drenched with urine stored overnight.

(12) A carabao exposed to a couple of pigs affected with rinderpest developed the disease and later died showing lesions of rinderpest on post-mortem examination.

(13) In another experiment a carabao contracted rinderpest when inoculated with blood from an infected pig.

(14) Two further experiments showed that pigs will contract rinderpest when inoculated with virulent blood from a carabao. One of the pigs died from the disease while the other showed symptoms but gradually recovered.

(15) Four pigs were placed in separate stalls in a shed where cattle affected with rinderpest were kept and both pigs and cattle were looked after by the same man. Three of the pigs died of rinderpest while the other showed symptoms but recovered.

(16) In another experiment ten pigs which had recovered from rinderpest were again exposed to the disease by contact with affected animals. It was discovered that apparently a permanent immunity was conferred on them against rinderpest after recovery from one attack—at least, for practically two years.

(17) Pigs which had recovered from rinderpest were shown to be capable of becoming infected later with swine fever in the course of an experiment in which four pigs which had recovered from rinderpest were separately exposed to swine fever by contact with groups of pigs suffering from this latter disease. Two of the pigs died and two showed symptoms of swine fever, while all on post-mortem examination presented lesions of the disease.

(18) In the last series of experiments pigs hyperimmunised towards swine fever were shown to be capable later of contracting rinderpest. Seven pigs which had been inoculated with very large doses of virulent swine fever blood were separately exposed by contact to bulls suffering from rinderpest in varying degrees of severity. All the pigs showed quite marked temperature reactions and three of them more or less well developed symptoms, but none died. These results indicate that no immunity was conveyed against rinderpest by the swine fever virus "although the animals ran a milder course of the disease than has been usually witnessed in the laboratory."

The author sums up the results of all these experiments as follows :—

> "It will be noted that cattle, carabaos and pigs vary but slightly in susceptibility to rinderpest, and that the disease can be transmitted practically as readily from one type of animal to the other, as among their individual kind."

[It is unfortunate that the existence of swine fever, especially in the case of the outbreaks among quarantined animals mentioned by the author, renders some of the experiments rather difficult to follow.—Ed.]

(d) VARIOLAE.

CAMUS (L.). **La Vaccine généralisée expérimentale.** [Experimental Generalised Vaccinia.]—*Bull. Acad. Méd.* 1916. Oct. 31 & Nov. 28. (Report extracted in *Rev. Gén. Méd. Vét.* 1916. Dec. 15 and 1917. Jan. 15. Vols. 25 & 26. Nos. 300 & 301. pp. 632 & 38–39 respectively.)

"Generalised vaccinia is an affection characterised by an eruption of vaccinal pustules in places that have not been in contact externally with the vaccinia. The eruptions are provoked by a localisation of the virus carried by the circulation. This affection is exceptional in the case of man; its existence has been doubted by very competent medical men. Chauveau, in 1856, experimentally reproduced this exanthema in the horse by intravenous injection of vaccinia; since then all similar attempts on other species of animals have remained without result.

"Camus shows that the cause of these failures lies in the use of insufficient quantities of virus. Invariably one obtains generalised vaccinia when a sufficient quantity of virus is passed into the blood stream. In the case of a dozen rabbits he succeeded a dozen times in reproducing generalised vaccinia. An animal is shown bearing numerous pustules which appeared spontaneously after an injection of vaccinia. The exanthema first appears on the third day, and is confined to the natural orifices and the parts surrounding them. The buccal cavity, tongue, lips, nostrils, eyelids, the perineal region, and parts of the skin where naevi are found, are predilection seats.

"A calf and a monkey are exhibited, both affected with a marked spontaneous eruption of vaccinal pustules provoked by an intravenous injection of homogenous vaccine. . . .

"The aspect of this exanthema in the case of the monkey is incontestably as typical as that of the calf but one cannot fail to remark that the mucous membranes have been infected with as great an intensity as in the case of the rabbit. The eruption on the calf on the contrary resembles much more that of the dog, in which the mucous membranes remained intact and in which the numerous pustules are located almost exclusively on the skin."

CAMUS (L.). **A propos de la Vaccine Généralisée chez le chien.** [Generalised Vaccinia in the Dog.]—*C. R. Soc. Biol.* 1916. Nov. 18. Vol. 79. No. 18. pp. 1008–1009.

The author presents a dog which he claims to be affected with generalised vaccinia following the injection of a large quantity (3 cc. per kilo). of vaccine virus intravenously. The first eruptions appeared on the seventh day on the skin of the head and on the limbs, and on the following day a large number of minute pappules were found disseminated on the whole surface of the body.

The disease produced was peculiar in that the visible mucous membranes were nowhere involved. The disease caused only a very mild general disturbance.

CAMUS (L.). **La Vaccine Généralisée chez le cobaye.** [Generalised Vaccinia in the Guinea-Pig.] *C. R. Soc. Biol.* 1916. Dec. 16. Vol. 79. No. 20. pp. 1108–1109.

A small guinea-pig which received 1 cc. of vaccine lymph intravenously showed a small pustule on the fourth day on the vulva; on the fifth day numerous eruptions were found on the buccal region, especially on the lips; on the sixth day the eruptions had become distinct and the edges of the nostril showed several while the tongue was covered with them.

In thus becoming localised on the mucous membranes the eruptions resembled those of the rabbit and of the monkey; on the other hand in the cases of the dog and the calf the mucous membranes are hardly ever affected.

GAUDUCHEAU (A.). **L'Immunisation variolique du singe.** [Variolar Immunisation of the Monkey.]—*Bull. Soc. Path. Exot.* 1916. Nov. 8. Vol. 9. No. 9. pp. 669–672.

The immunisation of the monkey by means of variola against vaccinia has recently been disputed by WURTZ and HUON, as well as by ROGER and WEIL. In this article the author records an experiment, carried out by him at the Vaccine Institute in Tonkin (French Indo China), from which the following results were obtained.

The variola virus was obtained from an Annamite, and two monkeys (*Macacus rhesus*) were inoculated by applying the virus to extensive scarifications along the back; one of these died following the inoculation while the other presented a very marked exanthema. The virus was collected from this latter animal and inoculated into two other monkeys and two buffaloes. Pustules developed on the monkeys, but none on the buffaloes.

About a fortnight after inoculation with the variola the above three surviving monkeys were inoculated on the buttocks and on outside of the thighs with Jennerian vaccine (etherised vaccine on right side and ordinary vaccine on the left). Three control monkeys were inoculated in the same way. In the case of the variolised animals no eruption developed whereas in the case of the controls typical pustules were observed, developing more tardily where the etherised vaccine was employed.

The author believes that it is quite possible to perform such experiments without accidental contamination in the first place with cow pox. He mentions that a strain of variola was kept up for three years in his laboratory by means of 43 successive passages in the monkey; during this time the virus was tested on more than 100 bovines and rabbits, always with negative results.

In conclusion, the author states that in the case of the monkey as in the case of other animals susceptible to variola and vaccinia a real immunity is conferred by variola against vaccinia.

MISCELLANEOUS.

(a) PLEURO-PNEUMONIA OF GOATS.

MORI (N.). **Sulla profilassi e sulla cura della Pleuropolmonite essudativa delle capre.** [Preventive and Curative Treatment of Exudative Pleuro-pneumonia in Goats.]—*Moderno Zooiatro.* Parte. Sci. 1916. Dec 31. Vol. 5. No. 12. pp. 285–289.

The work of this author in connection with exudative pleuro-pneumonia of goats has already been referred to in this *Bulletin*, [Vol. 4, No. 4, pp. 179–181]. In the articles then extracted he claimed to have discovered the causal organism which he stated was an Aspergillus, difficult to isolate from the lesions, but growing quite readily afterwards on sub-culture. He also described the presence of very minute corpuscles found both inside the leucocytes and free-lying in the pleuritic exudate. These he identifies as the conidiospores of the Aspergillus.

The disease has recently caused very serious losses in Central and Southern Italy, where the mortality sometimes exceeded 90 per cent. It seems probable that the disease was introduced from Serbia by means of fugitives during the war; it has been found that the disease actually existed in Serbia and Albania before the arrival of the Serbian goatherds.

The author refers to the impossibility of transmitting the disease experimentally by contact and of reproducing symptoms similar to those of the natural disease by inoculation.

Although experimental infection seems difficult or impossible to realise the author recommends segregation or slaughter of infected herds, inasmuch as in two outbreaks investigated infection was strongly believed to have been introduced by means of infected he-goats brought in for breeding purposes. Infection by indirect contact, due to the inhalation of the conidiospores of the Aspergillus, would likewise be eliminated. Disinfection of infected sheds, etc., is prescribed.

Good results in the prevention and cure of the disease are claimed to have been obtained by the inoculation of goats with a specific product consisting of the abundant serous exudate found in the pleural cavities of affected animals; this is freed of the tissue elements contained in it and treated with toluol or ether.

(b) EXTERMINATION OF LOCUSTS.

d'HÉRELLE (F.). **Campagne contre les *Schistocerca Peregrina* en Tunisie par la méthode biologique (Avril–Juillet 1915).** [Campaign of Eradication of *Schistocerca peregrina* in Tunis by Means of the Biological Method.]—*Arch. Inst. Pasteur. Tunis.* 1916. Apr. 1. Vol. 9. No. 3. pp. 135–143.

Conclusion.—" As applied to Tunis the organisation of destructive measures against migratory acridians by means of the biological method would not incur heavy expenditure and would have as immediate results the destruction of the greater part of the swarms of locusts situated in desert and uncultivated areas where mechanical methods of destruction cannot be applied on account of distance, lack of labour, and difficulties of accessibility.

" By reducing the number of locusts in the cultivated areas—and that n a more radical manner the more numerous the infestations, which

resolves itself into a question of personnel—the biological method applied in an intensive manner would facilitate to a very great extent the production of crops and prevent irruptions with certainty.

"On account of the considerable diminution in the number of locusts the expenditure necessitated for mechanical means of destruction would be greatly reduced; this diminution in the number of insects, by relieving the mechanical means of operation, would entail, in consequence, a reduction in the number of natives employed for these means, a very tangible advantage in Tunis for multiple reasons into which it would take too long to enter here."

Béguet. **Quatrième campagne contre les Acridiens (*Schistocerca peregrina* Ol.) en Algérie au moyen du *Coccobacillus acridiorum* d'Hérelle.** [Fourth Campaign against Locusts in Algeria by Means of d'Hérelle's Coccobacillus.]—*Bull. Soc. Path. Exot.* 1916. Nov. Vol. 9. No. 9. pp. 679–682.

Hitherto experiments in connection with the employment of d'Hérelle's method for the extermination of locusts in Algeria have been conducted by bacteriologists, but this year the possibility of its application being entrusted to laymen was recognised, while the bacteriologists only undertook the exaltation of the virus as well as the technique of preparation and spraying of virulent cultures. The locust invasion was especially serious in 1916 in Southern Oran, and some steppe country in this district was chosen for experiments.

The principle consisted in a very mobile body of men preparing the culture media themselves and receiving every day the exalted virus from the Pasteur Institute of Algeria. Details are then given as to how the broth was prepared in the field from concentrated products and inoculated with exalted virus. Twenty litres of broth could be prepared and sprayed each day while travelling about. One litre of a 36-hour culture was sprayed per hectare. The results of this campaign were briefly as follows:—

The coccobacillus produced an epizootic among locusts which, however, never led to the complete disappearance of the infected swarms. A marked destruction only took place when the experiments were performed a long time before metamorphosis occurred and when a large mass of insects all became infected on the day of the spraying.

The results were practically *nil* in alfa-grass districts where the pastures were too scanty. Propagation of the disease never extended appreciably for more than a kilometre from the direction followed by the locusts; a swarm moving through uniform country becomes sterilised. However, a veritable immobilisation of the sprayed swarms was produced even in cases where the epizootic assumed on great importance.

Velu (H.). **La lutte contre *Schistocerca peregrina* au Maroc en 1916 par la méthode biologique. Deuxième campagne d'expérimentation.** [Eradication of *Schistocerca peregrina* in Morocco in 1916 by the Biological Method. Second Experimental Campaign.]—*Bull. Soc. Path. Exot.* 1916. Nov. Vol. 9. No. 9. pp. 682–684.

The results of the preceding campaign in Morocco had shown that the conditions for success depended especially upon the season at which the infections took place, the most favourable time being when the insects lived in a compact mass, moved slowly, and when "acridiophagia," the principal factor in infection, was at its highest.

An account of the movements of locusts in Morocco is given. All the swarms which passed in a certain direction were found contaminated with the coccobacillus, and hence the author deduces that (1) it is quite impossible to exalt the virulence of the American strain of coccobacillus preserved *in vitro* since July 1915; and (2) the locusts born at the time of the passage of infected swarms are contaminated.

Large quantities of virulent broth were sprayed in certain districts and the following observations were made.

The most favourable time for the infections is at the end of the third stage of the young locust (12 day old). In such cases a mass of dead bodies up to 10 cm. in thickness was found in certain places.

When the fourth stage (12 to 20 day old locusts) is reached the propagation of the infection is much less certain. The sick locusts are then left in the rear of the swarm and die separated away from other insects, and are thus lost for purposes of contagion.

When the period of the last moult is reached the locusts are submitted to more and more stringent sanitary laws which bring about the automatic elimination of germ carriers.

The last stages of larval life are thus not favourable for the application of the method, especially in open country.

(c) SULPHUR DIPS.

CHAPIN (R. M.). **The Chemical Composition of Lime-Sulphur Animal Dips.**—*U. S. Dept. Agric. Bull.* No. 451. Professional Paper. 1916. Dec. 14. 16 pp. Washington, D.C.

This paper furnishes another contribution to the literature on the subject of lime-sulphur solutions. Some additional knowledge on the subject is claimed to be furnished in this paper inasmuch as the writer "has been able to develop some new methods of analyses which appear in several ways superior to former ones."

The general plan of investigation, involving the preparation of solutions according to different formulae and under different conditions with subsequent analyses and comparison of results, consisted in experiments regarding the effect of storage, effect of lime added after dilution, effect of varying lime-sulphur ratio, effect of varying period of boiling, effect of varying concentration, occurrence and relations of calcium sulphite, ratio of polysulphide to thiosulphate, lower polysulphides and the effect of excess of lime, and higher polysulphides and the effect of oxidation.

General conclusions regarding the chemical aspect of the problem are then given.

The practical applications deduced from the data presented by these experiments are detailed as follows :- -

"The subject has been dealt with by a number of investigators primarily interested in the preparation of such solutions for horticultural spraying purposes. Some of the formulas so developed seem to have given entire satisfaction for the purpose for which they were intended and the dilutions at which the resulting products should be employed under various conditions have become so well established that any change in formula would be of doubtful practical benefit. It is quite otherwise with solutions intended primarily for the purpose of dipping cattle and sheep. The formulas in use are those prescribed by the Bureau of Animal Industry many years ago when uncertainty regarding possible chemical reactions and possible effects of the resulting compounds upon both animals and parasites very properly led to the use of formulas which should be certain and safe, even if somewhat uneconomical. The formula here to be suggested is proposed therefore solely for use as an animal dip. It may be termed the '8-18-10' formula; that is, 8 pounds of high grade commercial quicklime, 18 pounds of fine sulphur (either flowers or flour) with somewhat more than 10 gallons water, boiled to a volume of 10 gallons at the finish. The time of actual boiling should be one hour. The theoretical ratio between lime and sulphur will be met by this formula if the lime is 98·3 per cent. pure, therefore the formula as given is appropriate for preparing a solution for dipping sheep where any chance of an excess of lime must be avoided. If commercial hydrated (not air-slaked) lime is used the amount should be increased nearly one-third, say to 10·5 pounds. For dipping cattle the formula may be used on the basis of available calcium oxide if the analysis of the lime is known, or if not known the lime may safely be raised to 8·5 pounds, corresponding to 92·5 per cent available calcium oxide, possibly even to 9 pounds. The manipulation of the materials in the actual process of preparation has been described in a recent publication from the Bureau.*

"The finished solution, drawn off from the sediment should theoretically contain 18 per cent. (grams per 100 cc.) of sulphid sulphur, but probaby will contain somewhat less. It is, therefore, appropriate for dipping sheep at a dilution of 1 volume of concentrate to 9 or 10 volumes of water, and for cattle at a dilution of 1 volume of concentrate to 7 or 8 volumes of water. But in any event, since baths lose strength during dipping, it is very desirable to keep them at all times under control by means of a 'field test.'†

"The particular advantages of the above formula are, first, that it closely approaches the theoretical ratio, making allowance for impurities; second, it is as concentrated a product as can be prepared without conversion of thiosulphate to sulphite; and third, the figures are easily remembered and readily converted into the quantities of ingredients necessary to prepare a batch of any desired size.

"In deducing a formula for the preparation of highly concentrated proprietary solutions it is evident that the manufacturer must make a few trial runs with plenty of sulphur in order to establish the conditions which will uniformly yield the product he desires, analysis of which will then inform him by how much he may safely reduce the sulphur to allow for the formation of sulphite."

REPORTS.

ACCRA LABORATORY. **Report for the year 1915.** [MACFIE (J. W. Scott).] 101 pp. F'cap. With 6 plates. 1916. London: J. & A. Churchill.

This report contains a description of the routine work of the Accra Laboratory, Gold Coast; for the first six months of the year this was undertaken by MACFIE while for the second half of the year a summary of the work done is given by BROHIER (S.L.).

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* IMES (Marion). Sheep Scab.—*U.S. Dept. Agric.*, Farmers' Bull., 713. 36 pp. 1916. Washington.

† CHAPIN (R. M.). A Field Test for Lime-Sulphur Dipping Baths.—*U.S. Dept. Agric.*, *Bull.* 163. 7 pp. 1915. Washington.

In addition, a list of the special papers published in various journals by Macfie is given, some of which have already been extracted in this *Bulletin.* A considerable number of further special investigations of importance are given in this report, references to some of which are made elsewhere in this number.

With regard to the routine examination carried out at the laboratory the following tables, reprinted from the report, are of veterinary interest:—

Trypanosome Infections found in Animals Slaughtered at Accra, January to June, 1915.

Host	Number examined.	Number with trypanosomes in the blood.	Percentage infected with trypanosomes.	Number infected with		
				T. vivax.	*T. congolense.*	*T. pecaudi.*
Cattle, hump-backed ..	48	45	93·7	33	14	6
Cattle, straight-backed ..	27	3	11·1	2	1	—
Sheep	33	1	3·0	1	—	—
Goats	29	1	3·4	1	1	—
Pigs	33	2	6·0	—	1	1
Totals ..	170	52	30·5	37	17	7

Babesia Infections found in Animals Slaughtered at Accra, January to June, 1915.

Host.	Number examined.	Number with Babesiasis.	Percentage with Babesiasis.	Number infected with	
				B. (T.) mutans.	*B. bigemina.*
Cattle, hump-backed	48	22	45·8	20	3
Cattle, straight backed	27	12	44·4	10	2
Sheep	33	8	24·2	8	—
Goats	29	—	0·0	—	—
Pigs	33	—	0·0	—	—
Totals	170	42	26·4	38	5

Examinations of Various Animals.

Animal.	Number examined.	Infections found.	Animal.	Number examined.	Infections found.
Bats	3	None.	Fish ..	1	None.
Birds:—			Hedgehog ..	1	None.
Fowls ..	8	None.	Lizards (*Ag. colonorum*)	2	*Haemogregarina* sp. in one.
Parrot ..	1	None.			
Small birds	3	None.			
Turkeys ..	4	*Halteridium* sp. in one; and inclusions in the leucocytes in one.	Mice.. ..	14	None.
			Monkey ..	1	None.
			Rabbit ..	1	None.
			Rats:—		
			Brown ..	22	*T. lewisi* in two; *Grahamella* in four; *N. decumani* in four.
Cat	1	None.			
Crocodiles ..	3	*Haemogregarina* sp. in one.			
Dogs	4	*T. congolense* in one.	Pouched ..	4	*Grahamella* in three.
Equines:—			Snake ..	1	None.
Donkeys ..	1	*T. congolense.*	Toads (*Bufo regularis*) ..	11	*T. rotatorium* in ten; *Haemogregarina* sp. in ten.
Horses ..	10	Trypanosomes of *T. congolense* type in five.			
Mules ..	17	Polymorphic trypanosomes? *T. equiperdum* in two.	Tortoise ..	1	*Haemogregarina* sp.

An account of the parasitic infections found in the course of examining blood films obtained from the Accra slaughterhouse was given in the Annual Report of the Accra laboratory for the year 1914 [see this *Bulletin*, Vol. 4, No. 2, pp. 81–83] and an account of the occurrence of babesiases and trypanosomiasis at Accra has been published in the *Annals of Tropical Medicine and Parasitology*, 1915, Vol. 9 [see this *Bulletin*, Vol. 4, No. 1, pp. 6–9].

For the second half of the year the examinations of the blood of animals from the slaughterhouse (by BROHIER, S. L.) gave the following results as to the occurrence of trypanosomes:

	Number examined.	Number infected.	Percentage.
Cattle	67	17	25·3%
Sheep	21	1	4·7%
Goats	22	—	—
Pigs	22	—	—
Totals	132	18	13·6%

"Examination of other animals.—Blood films from various animals were examined, but except in the case of 1 horse, 1 snake, and some rats, no parasites were found.

"The animals examined were 57 in number, viz., 1 pigeon, 1 cat, 1 dog, 1 duck, 1 horse, 3 hens, 1 cock, 1 sparrow, 1 bat, 3 snakes, 42 rats, and 1 hedgehog.

"Of the 42 rats examined six were found harbouring trypanosomes of the *T. lewisi* type, and three of the piroplasms alluded to in the last Annual Report as *Nuttallia decumani*.

"One case of equine filariasis was observed. The horse, the subject of this disease, was sent me by the police with a request for a report as to its fitness for work.

"The horse was emaciated; a watery discharge escaped from his nostrils; there was thickening and ulceration of the left lower eyelid at its inner angle, and a purulent discharge escaped from it. There was also a scanty purulent discharge from the right eye, but no signs of ulceration or of inflammation were present. The testicles were slightly enlarged and firm, the integument was thickened and honeycombed with shallow ulcers. Flies were constantly resting on these ulcers and apparently caused the unfortunate animal much discomfort.

"The coat was normal, but it was evident the animal had been greatly neglected, and several small shallow ulcers, mostly covered with scabs and abrasions were seen scattered over the body.

"An examination of the blood revealed numerous filarial embryos, very active, moving about with strikingly snake-like movements. No definite sheath could be made out, but the delicate transverse striation of the musculature of the body could be readily seen in specimens stained by dilute Giemsa. The anterior end was blunt, the posterior ending in a pointed whip-like tail. A definite clear space was noted between the anterior end and the commencement of the body nuclei; a clear collar-like space occurred about the point of junction of the anterior third with the posterior two-thirds of the body; and shortly behind the collar-like spaces a diamond-shaped orifice could be seen. A differential leucocyte count gave the following percentages: -polymorphs, 52%; large monos, 4%; eosinophiles, nil; large lymphos, 12%; small lymphos, 30%; hyaline and transit, 2%.

"Although examined for periodicity, none was apparent. The microfilariae were present in films taken in the day-time as well as in those taken at night; if anything the number was slightly greater in the films taken in the day-time.

"Ten days later the most noticeable feature was the presence of a large island of oedema over the most dependent parts of the abdomen, and the owner stated that when kept in the stall the legs became swollen. The testicles had greatly diminished in size, the integument was nearly normal, and the coat had greatly improved, though ticks were still found in the flexures and in the ears. The eye condition was, if anything, rather worse. Microfilariae were still present. Inoculations of the blood into guinea-pigs and rats were negative. At this stage the differential leucocyte count was as follows:—polymorphs, 68%; large monos, 2%; eosinophiles, 10%; large lymphos, 12%; small lymphos, 7%; basophiles, 1%.

"Some of the clinical features of this case were suggestive of trypanosomiasis, but no trypanosomes were found in the blood, although there was some degree of auto-agglutination of the red corpuscles in the specimens examined. It is impossible to say to what extent the symptoms described may have been due to filariasis."

British East Africa. **Department of Agriculture. Annual Report of the Veterinary Department for the Year ending 31st March 1915.** [Stordy (R. J.), Chief Veterinary Officer.]—pp. 115–124. 1916. Nairobi, British East Africa: Swift Press.

Diseases of Cattle. East Coast Fever. -Nine outbreaks occurred during the year. There are now 70 dipping tanks in good working order throughout the country, and the good results obtained by their use have convinced the settler community of the efficacy of regular dipping at three-day intervals as a preventive against East Coast fever. Several more dipping tanks are being constructed and the view is held that it is only by universal dipping that the suppression of East Coast fever can ever be anticipated. Some remarks on the forwarding of samples of dip for chemical analysis are included.

Rinderpest.—Twelve outbreaks of this disease occurred on European-owned farms. The disease is enzootic throughout most of the native reserves and owing to illicit movements of cattle from these reserves many outbreaks have occurred in the settled districts in the neighbourhood of these areas. It has been found possible to deal only with outbreaks affecting European-owned cattle. Double inoculation has thus been carried out on an extensive scale in many districts with most satisfactory results. The average mortality has been less than one per cent. More than 35,000 military cattle have been doubly inoculated since the war began.

230,384 doses of serum were sent out by the laboratory during the year, the greater part of which was exported to other countries.

Anthrax.—This assumed the form of an epizootic in two districts, the sudden increase of the disease being attributed to the shortage of grazing throughout the country resulting in cattle being compelled to graze closely and thus ingest considerable quantities of infected soil. 23,000 doses of anti-anthrax serum, prepared at the laboratory, were issued with most beneficial results. Unfortunately the vaccine in one case had regained its virulence and resulted in a number of animals succumbing to the disease.

Pleuro-pneumonia.—A recrudescence occurred in the Masai reserve in April. The cattle in five infected villages were quarantined, but the mortality was not large.

There were no cases of tuberculosis. Three outbreaks of blackquarter occurred and this disease appears to be on the increase.

Diseases of the Horse. *Epizootic* and *Ulcerative Lymphangites* were discovered in districts adjacent to the railway before the war. After the outbreak of war horses and mules were commandeered throughout the country and ulcerative lymphangitis was found to be existent among equines to a wholly unexpected extent.

Horse Sickness.—Fifty-six cases were reported and most of these occurred in Nairobi. The mortality from this disease has not been large for some years, and it is hoped that with better stabling of animals, etc., the death-rate will never reach the high percentage recorded in South Africa.

Sheep scab is ubiquitous, and while the hairy native sheep suffers little the causal parasite has disastrous effects on the wooled animal.

Goats.—Pleuro-pneumonia is widespread in the native reserves.

Pigs.—In order to eliminate the danger of infection with swine fever from wild porcines several farms have fenced their pig runs with wire netting.

"There is no country in the world where pigs can be reared so cheaply, and pig breeding is rapidly becoming one of the most lucrative industries of the Protectorate."

Dogs.—No cases of rabies occurred during the year.

Ostriches.—Castration was undertaken by the Veterinary Department.

Poultry.—Kikuyu fowl disease, an extremely acute form of fowl cholera has been the cause of large mortality in different parts of the country.

Details are added concerning the permit system, which acts as a check on the movement of native cattle, live stock importations, meat inspection, trading, and branding of stock; also an account of the co-operation of the Veterinary Department with the Military authorities since the outbreak of war is given.

BRITISH EAST AFRICA. **Department of Agriculture. Annual Report of the Veterinary Bacteriologist for the Year 1914–1915.** [MONTGOMERY (R.E.).] pp. 125–115. 1916. Nairobi. British East Africa: Swift Press.

The routine work of the laboratory consisted in examinations of slides and smears received from government officials and private owners, and in serum and vaccine preparation. The latter part of the work included the preparation of anti-rinderpest serum (274,368 doses), anthrax vaccine (32,180 doses), blackquarter vaccine (9,400 doses), colon bacillosis vaccine (701 doses), ulcerative lymphangitis vaccine (2,923 doses), and canine trypanblau (269 doses).

Diseases under Observation.

Anthrax.—See report of Chief Veterinary Officer.

Trypanosomiasis.—160 cases of the disease were diagnosed (105 in cattle, 52 in equines, and 3 in dogs). This represents a large increase over previous years and is due to the greater movement of susceptible animals within the areas inhabited by the tsetse fly. Large numbers of military animals were available for experimental treatment. The author believes that the number of diseases grouped under the name of trypanosomiasis or fly disease in the Protectorate is at least ten, the causal agents of which are distinct from a zoological point of view, and they differ in that recovery from the disease due to one type of trypanosome does not confer immunity against infection by another. Experiments were conducted with such drugs as 606, galyl, atoxyl, soamin mercury, tartar emetic, and arsenic in various forms and various combinations. No good results whatever were obtained, animals which had apparently recovered being still infective. HOLMES's method of treatment for Indian surra was applied in the treatment of a number of cases, but not one recovered.

Helminthiasis. Experimental work on the wire worm infection of sheep appeared to show that land will remain infective for at least 12 months after the removal of all sheep, and also that sheep may retain worms in their stomachs for at least six months although fed with artificial foods.

Considerable mortality has been experienced among cattle and these, on post-mortem examination, were found to contain a large number of worms in the fourth stomach. Experiments are being carried out to determine whether the infection of cattle is identical with that of sheep. Lysol has given the most uniform results in treatment; the dose now given is 8 ozs. of a 5 per cent. solution administered in the form of a drench on four successive mornings.

A worm invasion of the stomach of equines due to the genus Spiroptera was frequently encountered and it is believed that lysol administered in these cases produces a marked amelioration in the condition. Donkeys were especially found infected.

Oesophagostomum columbianum appeared to be the cause of serious mortality in young sheep in the case of one outbreak.

Diseases affecting Equines.

Ulcerative lymphangitis, due to the Preisz-Nocard bacillus, was diagnosed in 83 cases, the symptoms varying in intensity from an insignificant pustule to abscesses covering the whole of the body. On the Uasin Gishu plateau, where the disease is prevalent, it commences with the formation of one or more abscesses around the fetlocks, more particularly on the hind legs and spreads upwards towards the thighs and over the body, and in cases which end fatally internal abscesses about the size of a child's head are often found situated near one or both kidneys. In chronic cases a peculiar scab-like formation resembling a warty growth forms on the localised abscesses and microscopic examination of these scabs invariably revealed the presence of a streptothrix organism.

Successful results were claimed to have been obtained in the laboratory following treatment by means of weekly injections of a vaccine made from the Preisz-Nocard bacillus. A large quantity of this vaccine, however, when tried in the case of an outbreak of the disease in a certain district, failed to give satisfactory results.

Epizootic lymphangitis.—Thirty-one military animals were available for experimental treatment and over 20 privately owned animals and mules. The disease appears to be confounded with the last described disease due to the Preisz-Nocard bacillus. The results of treatment with "606" were good, but the expense of this drug makes it prohibitive except in exceptional cases. Mercurial cream failed to give the good results hoped for. The administration of potassium iodide either alone or in combination with biniodide of mercury yielded results which left little to be desired. In order to ensure success animals must receive a dose every day for approximately a month. The routine practice employed consists in the administration of half an ounce of potassium iodide and 5 grains of biniodide of mercury each morning in the drinking water, the supply of green grass and water being curtailed until the full dose has been drunk. Even in advanced cases of the disease a marked drying of all lesions is apparent after about the seventh dose. The thickening of the lymphatic cords decreases, nodulation disappears, and, in about a month, the animal, unless in a very advanced stage at the commencement, will fail to show any outward trace of the disorder.

Infectious Anaemia.—This disease is strongly suspected as being the cause of heavy mortality among donkeys and experiments are in progress in order to determine whether this is the case.

Horse Sickness.—"That true Horse Sickness does exist in East Africa is clear but the results which have been obtained by Sir Arnold Theiler with specimens of blood forwarded to him for experiment demonstrated that only a percentage of the suspected cases are affected with it."

Diseases of Cattle.

Rinderpest.—No experimental work was performed during the year; the manufacture of anti-serum has been referred to above. The virulent blood used in the double inoculation had to be maintained in the laboratory, and either used within 48 hours of dispatch or an infected susceptible animal was forwarded and its blood employed for the immunisations.

East Coast Fever.—With the establishment of dipping this disease no longer calls for much further experimentation, for if an owner regularly dips in a dipping fluid of standard strength his losses even during the first year will be very considerably reduced and after that period it is probable that all infected ticks will have been eradicated.

Statistics are given with regard to the cost of dipping, etc. During 12 months' use 41,712 cattle, 2,608 equines, and 5,914 sheep and goats were passed through the laboratory dipping-tank. The total amount of dipping fluid used was 27,586 gallons. WATKIN-PITCHFORD'S laboratory formula was adopted in the manufacture of the dipping fluid. Each 100 gallons for the three-day dipping thus contained:—Arsenite of soda (80 per cent. arsenic) 1 lb., soft soap $\frac{3}{4}$ lb., paraffin 2 lb. The cost of material worked out at 55·9 cents. per animal per annum.

Redwater and anaplasmosis.—Although dipping will eradicate both these tick-borne diseases from a farm it was sometimes found necessary to expose imported and other highly susceptible stock to areas which it had not yet been found possible to cleanse. A strain of anaplasma obtained from THEILER for the purpose of immunising such animals was found to be too strong to be tolerated with safety. With each successive passage the strain appeared to become markedly increased in virulence.

The blood of Uganda cattle was found to contain the causal organism of both redwater and anaplasmosis, and when inoculated into susceptible animals in doses of cc. induced a mild infection with redwater between the 8th and 12th day and anaplasmosis between the 20th and 50th day. The former reaction, if severe, was easily checked by means of trypanblau. It was noticed in the case of cattle from South Africa that the (second) reactions occurred between the 20th and 30th day, whereas in the case of stock from England the earliest reaction began on the 36th day and the latest on the 53rd day.

Of 15 shorthorns imported from England and immunised against rinderpest, redwater, and anaplasmosis by a single injection of Uganda blood in which the rinderpest virus was present, two died from anaplasmosis, the reactions to redwater and rinderpest being normal. Of four South African cattle immunised in the same way one died from anaplasmosis.

Colon bacillosis.—A vaccine made from the incriminated organism was issued to a number of stockowners for tests in the field, the method consisting in the injection of 5 cc. of emulsion containing 2,000 million of dead bacteria subcutaneously as soon after birth as possible. Reports were received which seemed to indicate that strikingly beneficial results have been obtained.

Blackquarter.- This disease had become more prominent during the year; 5,000 doses of a single vaccine were issued and in most cases it was claimed that the vaccination was responsible for checking the mortality. In one instance a considerable number of calves succumbed to infection following inoculation, although the vaccine in this case had apparently been rigidly tested prior to issue.

Contagious abortion.—This occurs on several farms, but no increase has been noted. The agglutination test has been employed in diagnosis.

Disease "C.H."—In the course of an epizootic resembling a mild outbreak of rinderpest a specimen of blood was tested and shown to be capable of infecting cattle immune from rinderpest, and that susceptible animals recovered from this disease might still be infected with rinderpest. The symptoms manifested were dulness, slight depression, and a high temperature lasting three or four days, accompanied with a dark foetid diarrhoea which later changed to constipation. There was some discharge from the eyes and occasionally the membranes of the mouth were somewhat inflamed. In calves the inoculation produced a more severe reaction than in adults. In Indian buffaloes the reaction produced was more severe than in calves and the affected animals showed such extreme depression that death appeared imminent although all recovered. Mules were found to harbour the virus in their blood from about the 6th to the 10th day after inoculation, although no symptoms were shown; five animals out of 43 inoculated died.

One attack of the disease confers an immunity which lasts three months. The virus appears to live in the blood corpuscles, serum is not virulent and the organisms do not appear to pass through either a Chamberland or a Berkefeld filter. Defibrinated blood loses its virulence in about a week. Attempts to reproduce the disease by contact failed. An anti-serum was made by hyper-immunising cattle with large doses of virulent blood.

Diseases of Sheep and Goats.

Nairobi sheep disease.—This has been responsible for considerable trouble at some of the military supply camps. It was proved that ticks of the species *Rhipicephalus appendiculatus* can transmit the infection as adults, after having been fed as nymphae on a sick animal.

Pleuro-pneumonia in goats.—This occurred in the form of a serious epizootic throughout the Protectorate in September 1914. It was possible neither to ascertain the causal organism, nor experimentally to infect healthy animals.

Diseases of Pigs.

Swine fever.—No outbreak of the East African form of the disease was reported during the year. The Uganda bush pig was shown to be immune to this disease; owing to the devastation caused by these animals in the native habitations an attempt at eradication had been made by trying to transmit this infection to them.

Diseases of Poultry.

Kikuyu fowl disease.—109 cases of this disease were diagnosed in the laboratory. Although the causal organism differs from that of fowl cholera it resembles it in that its virulence becomes lost with age. The preparation of a preventive vaccine was therefore made possible, but this has not yet been extensively applied in the field.

MUKTESAR LABORATORIES. **Annual Report of the Imperial Bacteriologist, for the Year ending 31st March 1916.** [SHILSTON (A. W.), Assistant Bacteriologist in charge]. 23 pp. 1916. Calcutta: Superintendent Government Printing. India. [Price 5*d.*]

This report deals with (1) administration, (2) preparation of sera and vaccines, (3) research work. Tables are appended showing the quantities of different products issued from the laboratory, and the main results of the working of the laboratory for the year.

Under the heading of preparation of vaccines a number of figures are given which are specially valuable on account of the very large scale in which these products were employed. Tables are given showing the number of outbreaks, etc., dealt with by the administration of these products in the various provinces. The table on the following page gives a résumé of the total results achieved.

The other products manufactured were anti-strangles serum and vaccine, mallein, a small quantity of tuberculin, and small quantities of various miscellaneous vaccines.

The results of examination of specimens received are given.

Research work.—Some general remarks are given with regard to this part of the work; no details are entered into, but the publication of the results of experiments is promised with regard to (1) observations on the preservation of rinderpest virus, (2) the immunising effect of dead vaccines in the case of anthrax and haemorrhagic septicaemia, and the standardisation of the anti-sera of these diseases [MACALISTER (G. H. K.)], (3) kumri, (4) the causal organism of abortion amongst mares and donkeys, (5) investigation of the transmission of surra by biting flies (HOWLETT).

Investigations into the drug treatment of rinderpest have been discontinued owing to the invariably unsatisfactory results obtained. It is stated that the value of both anti-serum and vaccines in the treatment of strangles among horses at two Army Remount Depots was frequently demonstrated.

The results of experiments performed with the object of increasing the output of serum and effecting economies in the course of its production have already been referred to in this *Bulletin* [see Vol. 4, No. 4, pp. 188-190 (NORRIS, R. V.)].

NIGERIA. **Annual Reports of the Agricultural Departments of Nigeria for the Year 1915.** 13 + 11 pp. 1916. Lagos: Govt. Printer. [Veterinary Report for the Year 1915.] [BRANDT (F. R.).] Appendix 1. pp. 5-7.]

On account of small staff employed the work has been rather limited, and has consisted mainly in tours with the object of instructing native cattle owners and obtaining information with regard to stock, grazing, water, and movements.

Rinderpest.—This appears to be the most important disease, but the mortality sometimes seems to be exceptionally low, varying from 5 up to 50 per cent., the latter figure being exceptional. Cases were seen in the early part of the year in Kano, Bornu, and Bauchi. It was found to be widespread in Sokoto Province as well as in French West Africa, where the disease appeared to be assuming a more virulent type. In June it was found to be again prevalent in Bauchi. In July the disease was found to have extended down the left bank of the Benue River to Muri.

No report of an outbreak of the disease was received during the latter part of the year. The disease thus followed a course which would lead one to suspect the possibility of its having been present for a long time in an endemic form, but of a character so mild as to have been

Table showing results of use of serums and vaccines issued from the Muktesar Laboratory.

Serum or Vaccin.	Number of outbreaks in which inoculation undertaken.	Number of animals which died un-inoculated in course of disease.			Number of animals inoculated.			Number of animals which died after inoculation.		
		Equines.	Bovines.	Others.	Equines.	Bovines.	Others.	Equines.	Bovines.	Others.
Anti-rinderpest serum ..	2,662	*Nil*	43,058	168	*Nil*	396,293	1,184	13*	2,765	6
Haemorrhagic septicaemia serum and vaccin ..	518	1	2,769	*Nil*	7	89,641	14	*Nil*	76	*Nil*
Anti-anthrax serum ..	118	33	861	401	769	12,541	558	1	27	*Nil*
Blackquarter (Charbon symptomatique) vaccin ..	94	*Nil*	274	*Nil*	*Nil*	9,168	*Nil*	*Nil*	14	*Nil*

* This is apparently an error.

overlooked by the stock owners until 1914, when by a slight increase in virulence a high death-rate resulted. The natives, however, state that this is the first time that the disease has appeared since the outbreak of about 25 years ago.

No inoculations seem to have been performed.

Pleuro-pneumonia.—Prevalent throughout the country.

Foot-and-mouth disease.—Is widespread but the mortality is not high.

Anthrax and *Blackquarter* appear especially towards the end of the dry season.

Trypanosomiasis.—Is found in every province, but is not extensive in the northern stock-raising areas, where most of the fly belts are known and avoided as much as possible.

NIGERIA. **Annual Report of Medical Research Institute 1915.**—[CONNAL (A.) & SINCLAIR COGHILL (H.).] 28 pp. f'cap. 1916. London: Crown Agents for the Colonies. [Price 2*s.* 6*d.*].

The following paragraphs of veterinary interest are reprinted from this report:—

Babesiasis.

"By the request of the Principal Medical Officer, a number of blood smears from domestic animals were sent to the Institute to be examined for the presence of babesiae." . . .

"In all, the blood of 332 animals was examined. Babesiae were noted in 10 out of 168 cattle, in one out of 66 goats, in eight out of 44 sheep and in three out of 21 dogs; no babesiae were observed in 28 pigs, four horses and one cat." . . .

Blood-sucking Flies.

"The insects enumerated were all obtained in the immediate neighbourhood of Yaba.

"Three specimens of *Glossina palpalis*, females, and two of *Stomoxys nigra* were caught in the laboratory in April.

"During May *Glossina palpalis* 18 ♀, *Stomoxys nigra* 8 ♀, *Tabanus secedens* 3 ♀, *Stomoxys omega* 2 ♀, *Tabanus socialis* 2 ♀, *Hippocentrum versicolor* 2 ♀, *Tabanus thoracinus* 1 ♀, and *Tabanus fasciatus* 1 ♀ were obtained." . . .

"During June *Glossina palpalis* 10 ♀ were taken, also *Stomoxys nigra* 28 ♀, *Stomoxys omega* 2 ♀, *Tabanus secedens* 1 ♀, *Hippocentrum versicolor* 1 ♀ and *Glossina tachinoides* 1 ♀." . . .

"In July *Glossina palpalis* 11 ♀ were captured, also *Mansonioides africanus* 4 ♀, *Anopheles costalis* 1 ♀ and *Anopheles mauritianus* 1 ♀.

"Only *Glossina palpalis* 1 ♀ was obtained in August, but three were taken in September, as well as one female specimen each of *Tabanus socialis* and *Tabanus taeniola.*

"During October, *Glossina palpalis* 3 ♀, *Tabanus taeniola* 4 ♀ and one *Tabanus socialis* ♀ were captured.

"In November there were *Glossina palpalis* 1 ♀, *Tabanus taeniola* 3 ♀, *Tabanus par* 1 ♀, *Tabanus kingsleyi* 1 ♀ and *Tabanus secedens* 1 ♀, and in December one female *Glossina palpalis* was caught.

"The total blood-sucking insects caught and identified was 535, and of this number 320 were dissected and examined.

"Smears were made of (*a*) proboscis, (*b*) cephalic muscles, (*c*) thoracic muscles and (*d*) intestinal tract. In most cases these smears were examined in the fresh as well as in the stained condition.

"During the earlier period of the investigation attempts were made to feed the insects, particularly the glossina, on clean guinea pigs, but this procedure was soon given up as it occupied too much time, and also because many insects which would not feed on the day on which they were caught were found dead next day and therefore had to be discarded altogether.

This occurred most commonly in the case of the glossinae, and the inference was made that these flies were not locally hatched, but had come with the trains (which pass close to the Laboratory) and were spent and bruised by their journey.

"Smears were examined from 47 *Glossina palpalis*. Trypanosomes were found in the proboscis of two and in the stomach of another two. Spirochaetes occurred in one. Mammalian red blood cells were noted in the stomach of five, avian red cells in one, and filarial embryos were observed in one of the five that had ingested mammalian blood. The remaining 37 insects showed nothing noteworthy. The trypanosome-infected flies were caught one in April, two in June and one in November.

"One specimen of *Glossina tachinoides* was examined with negative results.

"Smears from 18 *Stomoxys nigra* and from four *Stomoxys omega* were examined. The only interesting result was the findings of avian red blood corpuscles in the stomach of one *Stomoxys nigra*. These insects, however, were caught mostly newly hatched from the garden manure.

"Specimens of seven species of Tabanus, *T. taeniola* (8), *T. secedens* (5), *T. socialis* (4) and one each of *T. par*, *T. fasciatus*, *T. kingsleyi* and *T. thoracinus*, a total of 21 were dissected. Herpetomonas were observed in the intestinal tract of one *T. secedens*.

"Two specimens of *Hippocentrum versicolor* showed nothing of interest." . . .

"Trypanosomes were found in four specimens of *Glossina palpalis* (47 examined).

"Herpetomonas were noted in the intestinal tract of three *Culiciomyia nebulosa* (112 examined), one *Ochlerotatus nigricephalus* (31 examined) and one *Tabanus secedens* (five examined).

"Spirochaetes were observed in three *Culiciomyia nebulosa* (112 examined), one *Mansonioides africanus* (23 examined), one *Ochlerotatus irritans* (22 examined), and in one *Glossina palpalis* (47 examined)." . . .

"The trypanosome-infected glossinae were caught in April, June and November. The spirochaete-infected glossina was caught in June, the culiciomyiae, the Mansonioides and the ochlerotatus in May. The filaria-infected culiciomyia and the anopheles were both caught in May." . . .

"Mammalian blood had formed the meal in five *Glossina palpalis*, twelve *Anopheles costalis*, one *Anopheles mauritianus*, six *Mansonioides africanus*, seven *Culiciomyia nebulosa*, 17 *Ochlerotatus nigricephalus*, 10 *Ochlerotatus irritans*, one *Stegomyia fasciata* and one *Stegomyia luteocephala*.

"Avian blood had been ingested by one *Glossina palpalis*, one *Stomoxys nigra*, and 27 *Culiciomyia nebulosa*.

Both mammalian and avian erythrocytes were found in the stomach of two *Culiciomyia nebulosa*, one *Anopheles costalis* and one *Stegomyia luteocephala*.

"It would appear from these results that *Culiciomyia nebulosa* prefers avian to mammalian blood." . . .

Trypanosomiasis.

"Many of the blood smears from domestic animals showed trypanosomes, cows, sheep, goats, horses, pigs and dogs were all found infected.

"Cattle and horses appear to be especially prone to the disease, probably because they are more frequently to be found outside the immediate environs of a town or village than the other animals, and so are more exposed to the bites of tsetse.

"Blood smears from 168 cattle were examined. They were all sent to the Institute in the dried state. Trypanosomes were found in 49, that is 29·1 per cent. So far as could be judged most of the parasites were *T. vivax*, and a few resembled *T. pecaudi* (*T. brucei*).

"A single goat out of 66 examined showed trypanosomes, the parasite resembling *T. vivax*.

"Forty-four sheep were examined and trypanosomes were found in one, the species being apparently *T. vivax*.

"Three pigs out of 28 were found to harbour trypanosomes, resembling *T. pecorum* (*T. congolense*).

"Blood smears from 21 dogs showed trypanosomes of the *T. pecaudi* (*T. brucei*) type in two cases.

"Four horses were examined and trypanosomes of the *T. vivax* type occurred in two.

"One cat was examined, with negative result.

"The infection was mostly a heavy one in the cattle, horses and dogs, and a scanty one in pigs, sheep and goats." . . .

"Various blood smears from 23 snakes, mostly harmless green or brown colubrines, were examined in a search for the pigment-bearing parasites which have been described from a few of the cold-blooded animals. Haemogregarines were found in six. Haemoproteus or plasmodia were not found in any, although in two of the animals a few of the leucocytes contained pigment granules.

"Other cold-blooded animals examined were 3 fish, 2 frogs, 1 toad, 1 crocodile, 1 turtle and 4 small tortoises. Parasites were only found in one animal, the turtle, and these were haemogregarines.

"A variety of other animals was examined. Out of nine different birds, one, a small heron, harboured trypanosomes. Ten mice showed no blood parasites. Out of seven rats, *T. lewisi* was noted in four and *Grahamella* in one.

"Seven monkeys, 4 bats, 2 pottos and 1 porcupine were examined with negative results." . .

Vaccine Lymph.

"The following experiments were carried out at the request of the Director of the Medical and Sanitary Service with the object of ascertaining whether there would be any danger in employing cattle, suffering from an infection of trypanosomiasis or babesiasis, in the manufacture of small-pox lymph; in other words, whether or not these parasites in some latent form or other could be transmitted to people vaccinated with lymph prepared from cattle harbouring these same parasites.

"After several visits had been paid to the cattle market at Ebute Metta, two young cows were finally chosen—one infected with trypanosomes and the other with babesiae.

"Three attempts were made to vaccinate these but without success, Dr. Mackey kindly helping on the first two occasions. Finally both animals died. Again two similar cows were procured and a fresh supply of lymph was tried; this met with success and after some difficulty lymph was taken from both. Owing to the weak condition of these animals they had to be allowed a good deal of liberty, and the difficulty arose how to prevent them from rubbing or scratching themselves and so rendering the experiment useless as far as they themselves were concerned.

"Two monkeys, whose blood had previously been examined, were vaccinated successfully with this lymph. After the first day their temperatures were taken morning and evening every second day for three weeks and at irregular intervals following. Two months afterwards their blood was examined for the last time. No parasites of any sort were found, and their temperatures were normal throughout.

"A portion of the lymph was examined microscopically, and also added to the water of condensation of three agar tubes. The result in both cases was negative."

PUNJAB. **Annual Report of the Camel Specialist for the Year 1915-1916** [CROSS (H. E.).]—27 pp. f'cap. 1916. Lahore: Superintendent. Government Printing. Punjab.

This interesting report commences by giving tabulated summaries of the mortality returns sent in by the various Camel Corps under observation; as the author states, too much reliance cannot be placed on these returns as they were compiled largely from the statements of camelmen, yet they give a very good idea as regards the relative prevalence of certain camel diseases.

The total losses from deaths, and castings amongst the eight Silladar Corps, four Grantee Camel Corps, and the Local Transport, Dera Ismail Kahn, Bannu and Kurram Valley Militia were 2,800 = 25·1 per cent., whereas the total losses from deaths alone were 2,500 = 22·7 per cent.

The most noteworthy disease was surra; the number of cases diagnosed during the year was 1,593, and it is considered that the number in reality considerably exceeded this figure owing to the disease in various forms, especially when accompanied by brain symptoms, being wrongly diagnosed.

Experimental Work.

Anti-fly emulsion experiments. Details are given with regard to experiments conducted in smearing or spraying camels with various emulsions in places where surra was known to exist and where blood-sucking flies were prevalent.

The conclusions with regard to these various experiments are reproduced as follows:—

Creosol emulsion. Consisting of creosol, 1 oz.; pix liquida, 2 oz.; soft soap, 8 oz.; water, 3 pints.

"(1) Three pints of this emulsion are scarcely sufficient.

"(2) If the animals are kept in the shade the emulsion would appear to have some slight efficacy in warding off the attacks of Tabanidae.

"(3) After 12–13 hours the emulsion did not prevent the Tabanidae from biting.

"(4) If the animals are sprayed and kept in the sun the emulsion prevented Tabanidae from biting for half an hour only.

"(5) As soon as the emulsion has dried on the skin it does not appear to have the slightest efficacy against the attacks of Tabanidae."

Jensen's emulsion. (Kerosene oil, 1 gall.; powdered naphthaline, 4 ozs.; soap, 1 lb.; water, 4 galls.). At the time when these experiments were carried out the camels had little or no hair, and the sun was very powerful.

"(1) This emulsion prevents Tabanidae from biting for 12 hours.

"(2) The emulsion cannot be recommended for camels as it causes severe blistering of the skin."

Citronella oil. "This prevents Tabanidae and Stomoxys from attacking for a few hours, but it has no repellent action after 17 hours."

Cod-liver oil. "This does not prevent Stomoxys and Tabanidae attacking camels."

Aniseed oil. "(1) Tabanidae appeared on the sprayed and unsprayed camels at the same time. Aniseed has no repellent action against Tabanidae 2½ hours after application.

"(2) It has a slight repellent action against Stomoxys: the length of time it prevents Stomoxys from biting is so short that the oil cannot be considered to be of any practical value in warding off the attacks of the biting flies.

"(3) The application of only one pint causes great restlessness in the camel."

Castor oil. Four separate experiments were performed with castor oil and castor oil emulsion.

"The result obtained with 4 pints (which prevented Stomoxys and Tabanidae from biting for three days) was very different from that obtained with 3 pints (which prevented Tabanidae from biting a camel for 1 hour only), but I do not think it is due to the extra pint of oil used. At this time of the year the quantity of hair on camels varies greatly. The camel that was smeared with 3 pints had practically no hair, whereas both camels that were smeared with 4 pints had a fair quantity of hair. The matting of the hair by the oil might explain why the Tabanidae did not attack those parts where there is hair, but it does not explain why the Tabanidae did not attack the camels smeared with 4 pints on the sheath, etc., where there is never any hair on camels. In experiments with repellents for protecting animals from the attacks of Tabanidae and other biting flies the results obtained depend to a great extent on whether the flies are very hungry or not.

"Castor oil is of no practical value on account of the cost. Smearing a camel with 4 pints costs over Rs.2 8-0."

Blackquarter. In order to determine whether camels are susceptible to this disease three camels were inoculated with blackquarter virus, one young buffalo and one calf acting as controls. The results indicated that camels are as susceptible to blackquarter as bovines, and that the symptoms of blackquarter in camels are identical with those in bovines.

Haemorrhagic Septicaemia. - This disease causes a very large number of deaths in India amongst bovines; in order to determine whether camels are susceptible to this disease, two camels were inoculated with 2 cc. of culture, and two goats and two rabbits acted as controls. The results of these experiments appear to indicate that camels are not susceptible to haemorrhagic septicaemia.

Rinderpest.--Experiments to test the susceptibility of camels to rinderpest gave no result as the blood inoculated proved to be avirulent for control cattle.

Feeding experiments.---The average amounts of green fodder and water that can be ingested daily by a camel at rest when given a certain quantity of concentrated food were determined. It was found that :—

"(1) The average amount of green taramira that a camel will eat, when doing no work and receiving 6 lbs. of gram, is 66 lbs.

"(2) The average daily amount of water that a camel will drink when fed on green fodder and when the temperature is not high and doing no work is 2¼ gallons.

"(3) The average daily amount of water drunk by one camel, fed on gram and missa bhoosa, and doing ordinary work, was 5 gallons. When ridden on 2 successive days 14 miles (in the month of March when the temperature was not very high) the amount of water drunk was 9½ and 8 gallons, respectively."

Further experiments in this direction will be undertaken next year.

Sore throat.-- Details are given with regard to the history of one case of this disease, which appears to be fairly prevalent in camels. Nothing appears to be known as regards the etiology. It is stated that until the cause of the disease is determined all that can be done is to treat the symptoms.

"A dose of Epsom salts, 1-2 lbs. (according to the size of the animal) should be given at once. Fomentations may be applied to the throat, and green fodder placed in front of the animal. The animal should be placed in the shade and left alone. On no account should the camel be worried by allowing the camelmen to force food down its throat.

"Camelmen fire the throat and maintain that if this is not done the animal in every case dies; but if the throat is fired a number of cases recover."

Jhooling or *Jhoolak.*—"This is a contagious disease of camels manifesting itself in the formation of local tumours --hot and painful, of a fibrous character, and terminating in suppuration and raw patches." It is widely distributed throughout the Punjab and usually occurs in the cold weather; the etiology is unknown. Horses, cattle, buffaloes, dogs, guinea-pigs and rabbits appear to be immune, but the disease is easily transmissible by contact to healthy camels. Examination of the pus of the abscesses reveals the presence of streptococci.

Treatment consists in the excision of the lesion or the application of a blister in order to hasten abscess formation. The lesions heal up, leaving on the skin small white spots which last several months. With regard to preventive treatment it is advised that no camel should be bought if it presents such spots; also when a case occurs strict isolation should be enforced.

Rheumatism.—Camels suffer a great deal from articular rheumatism. No cases of muscular rheumatism were observed. The disease is very prevalent in all parts of the Punjab and appears to be caused by bad hygienic conditions, such as improper feeding, cold and damp, and apparently also by feeding on shisham leaves.

Wail.—This disease is common in one part of the Punjab and is characterised by loss of control of the hind legs with consequent difficulty in sitting down and getting up, thus resembling those of kumree in horses. The etiology is unknown, but the disease is probably due to grazing continuously on lana. Inoculation of blood into camels and other animals gave negative results. No therapeutic treatment proved beneficial.

A small experiment on dachi's milk indicated that " butter can be made from camel's milk," but that " it takes four times as long to get butter from camel's milk as from cow's milk."

Surra.—No attempts were made to treat camels by Commandants of the various Camel Corps except in one instance, where excellent results were obtained by the administration of arsenic alone and a combination of arsenic and soamin. The figures in this instance were as follows :—Total number of camels treated 158, number of camels cured 129, number of camels died under treatment 29, number of relapses nil.

Further experiments were carried out in connection with treatment; the following are briefly the results :—

(1) *Alternate doses of mercury perchloride and chinosol* administered intravenously (4 times altogether) apparently appeared to have effected a cure in the case of five diseased camels after from 13 to 15 days from the commencement of the treatment. Relapses, however, occurred in all cases between the 10th and 28th day after the last dose of chinosol. It is concluded that alternate doses of these drugs given intravenously in as large doses as can be tolerated have no curative action against surra.

(2) *Alternate doses of iodine and soamin* with intervals of one day between each dose did not give satisfactory results.

(3) *Alternate doses of iodine and mercury perchloride* gave very unsatisfactory results.

It is stated that a variety of other drugs were tried, none of which gave satisfactory results.

Experiments were carried out with regard to the course that surra runs in the camel and also in ponies. The camel experiments are apparently not yet completed. It was found that ponies are susceptible to camel surra, but that the course which the disease runs in old and in young ponies is very different. The same difference is noticed when old and young camels are inoculated with surra. In the case of old camels death takes place rapidly whereas in one year old camels the disease does not run a rapid course. Surra may produce cerebral symptoms in ponies and these symptoms are also seen at times in camels suffering from the disease. Pus in the sinuses may be produced. Surra does not always cause emaciation.

In the case of two goats inoculated with camel surra, although no trypanosomes could be observed in the peripheral circulation of either goat, blood was shown to be infective; when 1 cc. of blood was injected (126 days after the goats were inoculated with camel surra) into rabbits and guinea-pigs, these animals developed surra.

Three sheep were inoculated with blood from a camel suffering from surra. In two, trypanosomes appeared in the peripheral circulation after an incubation period of 10 days, and in the third after 11 days. The paroxysm lasted two to four days; the blood of each sheep was daily examined for 115 days but no trypanosomes were again observed.

With the object of ascertaining whether old camels are immune to surra a camel 18 years old was procured that had been on the strength of a certain unit for over 13 years, and thus must have been through several surra outbreaks. When inoculated with infective blood, trypanosomes appeared in the circulation on the seventh day after inoculation and were present except on one day until the animal died 18 days after the inoculation. Three one year old camels, inoculated with surra at the same time as this old animal, developed the disease with frequent paroxysms at the commencement, but gradually these became less frequent and all three improved in condition and at the present time would not be suspected of having surra.

In the course of an investigation as to the cause of an outbreak of surra at Chakdara valuable information was obtained as to whether camels suffering from the disease are dangerous to ponies. Tabanidae were swarming in the camp and a high proportion of the camels were infected. After a few weeks 5 out of 14 ponies kept at the same camp were found to be suffering from surra. It is concluded that the ponies contracted the disease from the camels and that thus ponies should not be kept in contact with camels.

The report concludes with a description of an outbreak of anthrax and of another outbreak of a disease of unknown origin.

UGANDA PROTECTORATE. **Annual Report of the Department of Agriculture for the Year ended 31st March 1916.**—62 pp. f'cap. 1916. Entebbe: Government Printer. [Report of the Chief Veterinary Officer [HUTCHINS (E.).] pp. 40–43.]

Rinderpest.—The work of the year was almost entirely confined to the inoculation of cattle in the Mengo district of the Buganda Province, and in bringing a widespread outbreak in that district under control. The disease appeared in the early months of 1915 on the extreme eastern side of the district near the Nile, but early in May it appeared in the Bukoba division of Kiagwe, an area heavily stocked with cattle, the infection having spread from the neighbouring infected areas in Bugerera. Between May 20th and July 26th, 5,007 cattle were inoculated in the Bukoba division; the deaths amongst the non-inoculated cattle were estimated at 1,800, or about 80 per cent. of the non-inoculated stock.

In July the disease further extended into the neighbouring county of Bulemezi and spread rapidly northwards along the Sezibwa River into Buruli. Inoculation camps were formed at two places, where inoculations were carried on until the end of October, to cope with the rapid spread of the disease in Bulemezi.

In October outbreaks occurred simultaneously in other centres, all these being probably due to the illicit movement of cattle from the infected areas in Southern Bulemezi.

Another inoculation camp was opened near Entebbe in November; owing to the prevalence of trypanosomiasis amongst the cattle in the surrounding districts it was not considered advisable to perform the double inoculation. Cattle here were thus inoculated with a protective dose of serum only; in some instances this gave unsatisfactory results as several herds were inoculated whilst in the incubative period.

Many of the herds from Buruli sent for inoculation were found to be heavily infected with trypanosomiasis. In Buruli the buffalo and the bush pig were reported to have died in considerable numbers.

In these districts the total number of adult cattle inoculated was 13,833; deaths, 1,959; calves inoculated, 3,438; deaths, 1,106.

In the Eastern Province rinderpest has been prevalent since it was introduced from British East Africa in 1910; losses appear to have been mainly confined to the young stock.

The Western Province still remains free from rinderpest.

Trypanosomiasis.—Many of the Buruli herds from near Lake Kioga were found to be heavily infected, heavy losses being caused amongst transport cattle. *Glossina morsitans* continues to spread in an easterly direction in Southern Ankole.

Foot-and-mouth disease.—Has been prevalent in Ankole during the past two years, and, in the great majority of cases, it appears in a very mild form.

Diseases of Equines.—Lymphangitis was, as usual, the most common disease amongst mules.

RECENT LITERATURE.

[Continued from this *Bulletin*, Vol. 4. No. 4, pp. 201–205.]

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[There is nothing new in this method. It simply consists in using the blade of a pair of scissors or of an old knife for drawing out a drop of blood along a slide by means of capillary attraction.—ED.]

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TROPICAL DISEASES BUREAU.

TROPICAL VETERINARY BULLETIN.

Vol. 5.] 1917. [No. 2.

DISEASES DUE TO PROTOZOAN PARASITES.

(a) "Black-head" in Turkeys [Amoebiasis (?)]

Smith (Theobald) & Smillie (Ernest W.). **Note on Coccidia in Sparrows and their Assumed Relation to Blackhead in Turkeys.**—*Jl. Experim. Med.* 1917. Mar. 1. Vol. 25. No. 3. pp. 415–420. With 1 table.

The authors were induced to study coccidiosis in sparrows on account of the constant appearance of these birds in the unprotected yards of incubator-hatched turkeys and on account of the view of Hadley (1910) that the causal parasite of "blackhead" described by the first-named author in 1894 as *Amoeba meleagridis* is merely a stage in the development of the avian coccidium *Eimeria avium*, and is disseminated and transmitted by various species of birds. No experimental proof has, however, been furnished to support the latter view.

In all 54 sparrows were trapped or shot in the experimental turkey yard at Princeton, N.J.; no visible signs of disease were discoverable in any. Search was made in scrapings from the duodenal mucous membrane for the sexual stages and for sporulating forms in the rectal contents by sowing on a medium consisting of 2 per cent. agar in 0·5 per cent. watery salt solution. Sections were also cut from the duodenum for histological study. The results showed that 43 of the birds, or 80 per cent., were infected with coccidia. The sparrows were all adults.

The parasites in the duodenum were all in the sexual stage, macrogametes and macrogametocytes being the only forms present; they were situated in the nuclear zone of the epithelial cells. The total absence of the vegetative or multiplicative cycle suggests that either the sexual phase is suppressed or else it takes place possibly while the birds are still in the nest.

Cultures of faeces uniformly demonstrated a two-spored oocyst and not the four-spored species described by Hadley. Each sporocyst contained four sporozoites. According to Hadley the average measurements of the mature cysts in the turkey were 14 by 21 microns and in the sparrow 22·7 by 21·3 microns, thus indicating that the infesting species are different. The authors' own measurements of the coccidia agreed with those given by Hadley.

The authors conclude that the two-spored coccidia found by them belonged to the genus *Diplospora* (Labbé, 1893) or *Isospora* (Sjöbring, 1897), and not to *Eimeria*.

In a footnote the authors refer to a paper recently published by Hadley ascribing the so-called "blackhead" of turkeys to invasions of Trichomonas [see below].

Smith (Theobald). **Some Field Experiments bearing on the Transmission of Blackhead in Turkeys.**—*Jl. Experim. Med.* 1917. Mar. 1. Vol. 25. No. 3. pp. 405–414.

In the experiments described in this paper the author first shows that it is quite possible to breed healthy young turkeys from the eggs of infected adults. Details are given with regard to the precautions taken in incubating the eggs artificially.

It has been often suggested that the parasite of the disease may be carried or disseminated by poultry, but no conclusive experiments have hitherto been made in connection with this point. The author thus exposed two lots of incubator-hatched young turkeys to contact with domestic fowls—one lot to two fowls from a farm where no turkeys were reared and the other lot to two fowls from a farm where blackhead had caused extensive ravages. The results in both cases were negative.

Both lots of young turkeys were subsequently kept in contact with an infected adult turkey on non-infected ground. This exposure led to disease within 17 days. Out of 9 young turkeys 3 died, 2 recovered, while 4 did not show any symptoms.

Exposure to infected adults on infected ground similarly produced the disease in two lots of young clean turkeys. These were exposed on two farms where the disease existed.

Four of the incubator-hatched young turkeys were placed in contact with infected young turkeys. The exposed birds remained healthy although two of the turkeys they were exposed to died of the disease. From previous experiments the author also concludes that infection is either not transmitted at all or only under exceptional conditions by turkeys in the early acute stage of the disease. It is probably carried and shed by those birds which have successfully passed through an attack.

It is then stated that the mode of transmission of the infection is not known; it appears probable that it is introduced with the food and lodges first in one or both caeca and that faecal matter is the vehicle of infection. The lesions in the intestinal tract are often confined to one caecum only, thus making it improbable that the parasite multiplies higher up. Histological sections of the small intestine moreover failed to reveal any preliminary stage of *Amoeba meleagridis* although in some sections a few rare coccidia were found. It appears that adult turkeys are somewhat more resistant to the disease than the young birds. The lesions in the liver and caeca are associated rather early with an extensive infiltration of round cells while the tendency to necrosis is relatively slight.

HADLEY (Philip B.). **The Part Played by the Goblet Cells in Protozoan Infections of the Intestinal Tract.**—*Jl. Med. Res.* 1917. Mar. Vol. 36. No. 1. pp. 79–86. With 1 plate comprising 11 figs.

In this paper the author indicates the manner in which the flagellate protozoon Trichomonas penetrates the intestinal epithelium in the so-called " blackhead " of turkeys. Organisms of this kind are almost invariably present in the intestinal tract of all animals, but in this disease they appear to undergo a most remarkable development in the deeper mucosa, submucosa, and even in the muscular tissues of the intestinal wall.

The mode of entrance of the parasites was studied by examining the caecum histologically in the early stages of the disease. It was found that the first indication of infection consisted of a bulging out of the lumen of the crypts of Lieberkuhn with a tremendous number of flagellate trophozoites. These had been liberated from the spore mother cells which were abundantly present in the fluid caecal contents and had migrated up the crypts. " They possess the usual Trichomonas features—three anterior flagella and one posterior, a vibratory membrane, nucleus, blepharoplast, rhizoplast, chromatic line, chromatic blocks, axostyle, and nucleus. They are actively motile and measure from 8 to 10μ in length. Their shape is at first crescentic and later oval."

A few of the goblet cells lining the gorged crypts are then seen to contain from one to three or more flagellates. In these cases there is usually a broad opening from the goblet cell into the lumen of the crypt. In many cases there is in addition an opening through the basement end of the cell into a space between the epithelium and its basement membrane and this space may be seen to contain varying numbers of flagellate trophozoites. It is stated that all stages in the passage of the parasite can be seen if one observes a sufficient number of crypts.

The author believes that the parasites effect their passage by means of their " inherent invasive powers " and not on account of the internal pressure within the distended crypts; a goblet cell may be seen to contain only a few parasites although there is considerable distension within the crypt. The invasion of the cells takes place almost entirely in the region of the fundus.

The parasites next accumulate beneath the epithelial cells detaching them from the basement membrane until the greater number of the parasites that were formerly within the crypt become situated beneath the epithelium. This penetration sometimes results in the disorganisation and disintegration of the epithelial cells, but often the pressure now caused by the parasites causes the epithelium of the fundus to be gradually forced out of the crypt space towards the lumen of the caecum.

The parasites meanwhile penetrate the basement membrane and then the remainder of the mucosa is equally overrun until the muscularis mucosae is reached. This retards their progress for a very short time and then they are found developing in the submucosa. At the same time they spread down through the reticular tissue of the cores of the villi until they have reached the tips where they cause the epithelium to separate from the basement membrane and fall into the lumen of the caecum. Finally, no trace of epithelium can be observed in this area.

The author's observations thus point out that these organisms do not by their own movements effect an entrance between the epithelial cells and that a passage is not necessarily prepared for them by other intestinal organisms such as coccidia or worms. Small numbers of amoebae, together with the flagellates, were sometimes seen by the author in the depth of the crypts, but they were not seen either in the goblet cells or in the deeper tissues; he believes that they are thus of only very slight significance in the pathology of intestinal infections in poultry. "*Amoeba meleagridis* of Theobald Smith is not an exception to that statement, since this organism is not really an amoeba but really the late trophozoite stage of the parasitic flagellate forming the subject of this paper."

HIGGINS (C. H.). i. **Entero-Hepatitis or Black-Head in Turkeys.**—*Dominion of Canada. Dept. of Agric. Health of Animals Branch.* 1915. Feb. 13. *Bulletin No. 17.* With 4 plates. Ottawa: Govt. Printing Bureau. 1915.

— ii. **Entero-Hepatitis or Black-Head and the Biological Laboratory System of Raising Turkeys.**—*Ibid. Bulletin no. 19.* 1916. Jan. 18.

In these papers the author first notes the ravages caused in recent years throughout Canada, the United States, and elsewhere by the above disease, which was first investigated by Theobald SMITH in 1895 and attributed to a parasite called by him *Amoeba meleagridis.* This parasite invades the liver and the two caeca and causes lesions in them, hence the name entero-hepatitis. The losses from the disease are enormous and on some farms amount to 90 per cent. of the young birds. "There is little doubt but that the major portion of the fatalities after the first two weeks result from infection from the parasites of entero-hepatitis or blackhead."

The symptoms of the disease are not particularly characteristic but the affected birds show signs of dulness and exhaustion, and the faeces are more fluid than normal and show yellow streaks and gas bubbles; the head is usually darker than normal. The affected birds usually die in a few days if not treated and on post-mortem examination the liver is found to show yellowish-white circular spots on its surface and usually one or both caeca contain yellowish patches about the size of a walnut; sometimes the whole intestinal tract is inflamed. The author then gives rules with regard to prevention and treatment. Hydrochloric acid has apparently given good results in the treatment of the disease in a few cases.

Infection may be transmitted through adult recovered turkeys, which become chronic carriers of the parasites, and through other poultry such as chickens, which harbour the parasite without being seriously affected by it; ground previously occupied by affected flocks, boots and clothing of attendants, and birds, insects, etc., may carry on the infection. There is a good deal of evidence to show that infection is not transmitted through the egg.

For the prevention of the disease by the so-called "biological laboratory method" of artificial incubation and isolation the following plan was adopted. The section of the farm utilised was divided up into plots each about 1 acre in surface extent and surrounded by a suitable wire fence. Between the plots a vacant strip from 3 to 5 ft. wide was left and the gateways so arranged that entrance could not be effected direct from one plot to another. The ground containing the turkey plots was surrounded by a boundary fence at a distance of about 10 ft. from the outer plot. Each plot contained a colony house 10 by 12 ft., one side of which is left open. A flock of 25 turkeys could be raised in one plot.

The poults are obtained from eggs by artificial incubation and transferred to the warm chamber or so-called "hover" in the colony house. The author then details at length the care required by these poults. No food is given for the first three days as there is abundant nourishment still in the yolk sac. They are then given a soft mash diet about five times a day and a little water or sour milk and fine grit. In about two weeks time they may be allowed out of the colony house into a run which is covered over so as to protect them against hawks and crows. After a few weeks they are fed three times a day on mixed grain and allowed to roam at will in their plot. Mixed grain together with grit is meanwhile left for them in the colony house and the bedding changed from sand to chaff or straw. Moisture is fatal to young turkeys and every care should be exercised to prevent them getting wet with rain or even dew.

Should one individual poult be found to have a diarrhoea containing yellow particles or froth it must be immediately isolated and the whole of the colony house cleansed and disinfected. The shelters should be thoroughly disinfected at the beginning of each season.

The author considers that the results obtained by this method, as given in the second paper, were quite satisfactory.

(b) LEISHMANIASIS.

BOUILLIEZ (Marc). **Recherches expérimentales sur** *Leishmania tropica.* [Investigations on *Leishmania tropica.*]—*Bull. Soc. Path. Exot.* 1917. Jan. Vol. 10. No. 1. pp. 66–86. With 1 text fig. & 2 tables.

The virus used in these experiments was obtained from two natives affected with oriental sore examined at Fort Archambault. A description is given of the parasite and of pathogenicity tests on various experimental animals by means of intradermic and intraperitoneal inoculation. The author's conclusions are as follows:—

> "The African monkeys belonging to the family Cercopithecus (*Cynocephalus, Cercopithecus patas, Cercopithecus callitrichus*) are susceptible to *Leishmania tropica*, and in them a cutaneous lesion resembling the human oriental boil is produced at the point of inoculation.
>
> "They do not react to intraperitoneal inoculation.
>
> "The same results are produced in the case of the dog.
>
> "Small rodents belonging to the rat genus, or some nearly related genus, become affected with a generalised infection following intraperitoneal inoculation and this is manifested by the presence of *Leishmania tropica* in the blood-forming organs and certain viscera; this is accompanied generally, after a certain interval, by the appearance of local lesions, during the development of which the infection may disappear from the viscera and organs primarily affected."

LAVERAN (A.). **Au sujet de l'évolution des infections expérimentales des petits Rongeurs par** ***Leishmania tropica.*** [The Evolution of Experimental Infections by means of *Leishmania tropica* in Small Rodents.]—*Bull. Soc. Path. Exot.* 1917. Feb. Vol. 10. No. 2. pp. 110–113.

In this article Laveran criticizes BOUILLIEZ's memoir (extracted above). Although the two authors are in agreement on many points their opinions differ as to the sequence of the pathogenic effects produced by *Leishmania tropica* in small rodents. Laveran then details some experiments performed on white mice with the virus in his possession. It is admitted that the virus employed by BOUILLIEZ might have shown greater activity. The author concludes that with the virus of oriental sore which he used in inoculating white mice intraperitoneally or into the peritesticular connective tissue the local effects, ordinarily manifested by the presence of a testicular swelling, precede the general infection; this, moreover, may be altogether absent when an early post-mortem examination is made.

(c) PIROPLASMOSIS.

SPARAPANI. **Trasmissione dell' infezione da** ***Piroplasma ovis*** **in tre suini per via digerente.** [Transmission of *P. ovis* to Three Pigs by Ingestion.]—*Pathologica.* 1917. Jan. 15. Vol. 9. No. 196. pp. 21–22.

Three young pigs in a poor jaundiced condition were brought in for slaughter and on post-mortem examination the usual changes accompanying parasitic blood destruction were observed, viz., swelling and softening of the spleen, enlargement and yellowish colour of the liver, congestion of the kidneys, dark red urine in the urinary bladder, and petechiae on the various mucous and serous membranes.

Smears from the peripheral blood stained by Giemsa showed numerous red corpuscles invaded by a piroplasm which from its structure, form, and dimensions was identified as *P. ovis.* It was found on enquiry that a couple of months previously these three pigs had eaten several times the flesh of sheep which had died in their pens. Examination was then made on the farm of blood smears from sheep which were clinically suspected of being affected with piroplasmosis on account of their poor condition and yellow mucous membranes, and in some of these smears numerous corpuscles were found invaded with *P. ovis.*

Though the great majority of observers assert that piroplasmosis is transmitted only by the bites of ticks the author quotes in support of his own observation the results of NAWROTSKY's experiments in infecting dogs by the direct administration of piroplasm-containing blood into their stomachs; also, LANFRANCHI demonstrated the transmission of *T. brucei* and *gambiense* to pups sucking bitches artificially infected.

VAN SACEGHEM (R.). **Cas suspects d'*****East Coast fever*** **au Congo.** [Suspected Cases of East Coast Fever in the Congo.]—*Bull. Soc. Path. Exot.* 1917. Mar. Vol. 10. No. 3. pp. 172–173.

The author observed at Zambi, Lower Congo, in bovines an affection which showed clinical symptoms and lesions corresponding exactly with those of East Coast fever, but in which he failed to demonstrate the presence of Koch's blue bodies. The symptoms were fever, inappetence, stiffness, progressive paresis of the hind quarters, and enlargement of the glands; there was no haemoglobinuria. In some cases the animals were observed to be quite healthy in the morning, become paralysed in the evening, and die during the night.

On careful examination the possibility of trypanosomiasis, piroplasmosis, anaplasmosis, or poisoning was eliminated.

On post-mortem examination the liver was found to be enlarged and yellowish in colour; the lymphatic glands were enlarged and haemorrhagic; the kidneys and liver were scattered with yellowish-white infarcts, the spleen was not hypertrophied, and the intestine was affected with a haemorrhagic enteritis. In the red blood corpuscles a very few rod-shaped bodies identical in shape with Theileria were discoverable; no Koch's blue bodies were found. The disease terminated in death in all the infected animals and the mortality in the course of a few months rose to 40 per cent. of the cattle of the district.

LEGER (M.) & MOUZELS (P.). **Piroplasme et microfilaire d'un Edenté, le *Bradypus tridactylus* Linn.** [Piroplasm and Microfilaria of an Edentate *Bradypus tridactylus* Linne.]—*Bull. Soc. Path. Exot.* 1917. Mar. Vol. 10. No. 3. pp. 173–176.

In the edentates of French Guiana MESNIL and BRIMONT have described the following haematozoa, viz., an endotrypanum and a trypanosome of *Choloepus didactylus* (two-toed sloth), a trypanosome and a microfilaria of *Tamandua tridactyla*, and a microfilaria of *Bradypus tridactylus*, commonly known as "Ai" (or three-toed sloth).

In the red blood corpuscles of a wild specimen of the last-named species caught by the authors a piroplasm was also discovered. The parasites were fairly numerous and presented different appearances. The most common form was from ·5 to ·8μ in diameter, oval, and almost entirely filled up with an irregularly shaped nucleus staining deeply red. Other parasites were from 1 to 2μ, pear-shaped or oval, and containing a nucleus which was sometimes compact and sometimes represented by a slender filament which assumed very variable shapes. Very rare bacillary forms also were seen, some of which were about 1μ and truly rod-shaped, and others slightly curved, about 2μ in length and match-shaped. The multiplicative forms remained small in size and hardly ever exceeded 2μ in diameter. The chromatin became separated out into from two to six small masses and when segmentation was complete each nucleus was surrounded by a scarcely visible protoplasmic zone.

The red corpuscles invaded were of normal size and appearance while the other corpuscles also presented no changes in morphology or staining-reactions. No anaplasma-like bodies were seen. The leucocyte count was normal.

It was exceptional to find more than one parasite in the same corpuscle and the organism was disposed rather towards the periphery of the corpuscle. Smears from various organs showed no particular abnormality and no bodies similar to Koch's blue bodies were discoverable.

According to the authors the parasite falls into the genus Theileria, created by BETTENCOURT, FRANÇA, and BORGES (1907) for piroplasms of which certain elements are bacillary in form and which in dividing give rise to daughter elements in the form of a cross and very poor in cytoplasm. The authors give the name *Theileria brimonti* to this new species.

A tick belonging to the species *Amblyomma varium* Koch was found on the affected animal.

In smears from the blood and especially from the lung of the above animal a microfilaria was discovered which was identified with *Microfilaria kerandeli* Brimont. The dimensions were as follows:—cephalic spot 4·5μ, from this up to the first clear space 37·5μ, from this up to second clear space 23μ, second clear space 5μ, from this up to posterior extremity 105μ.

(d) SPIROCHAETES.

MACFIE (J. W. Scott). **The Morphology of Certain Spirochaetes of Man and other Animals.**—*Ann. Trop. Med. & Parasit.* 1916. Dec. 16. Vol. 10. No. 3. pp. 305–343. With 6 figs. and 8 tables.

In the introduction to this article the author discusses the measurement of the lengths of spirochaetes as a test of species. It appears to be extremely difficult to distinguish the smaller spirochaetes by morphological characters and in the case of any one species the staining reactions, thickness, and structural characters vary with the chemical composition of the surrounding medium and the method employed in putting them in evidence. The technique of cultivation is moreover laborious and difficult.

Length is perhaps the morphological character which promises to be of greatest assistance in identification, notwithstanding the fact that considerable variations are known to occur in a single species. The method proposed by the author is to draw a large number of spirochaetes with the aid of a camera lucida, to measure the drawings either by the tangent line or compass method, and to plot the lengths as a curve. By this method the great majority of the spirochaetes of the same species are found to measure within a few microns of each other in length.

The measurements may be grouped in the following manner:

> "First there come a few very short forms, which are probably either abnormally small individuals or, in the case of spirochaetes possessing an intracellular phase, immature specimens that have been prematurely freed in the process of making the films. Then there come the normal single spirochaetes which form the dome of the curve and extend over a range of 3 or 4 microns. . . . This is . . . the characteristic length of the organism. Next come the pre-division forms and the forms already differentiated into two daughter spirochaetes, united end to end by a delicate filament; and at this point on the curve a small subsidiary crest or halt in the descent may be observed, due to the overlapping in length of large single and small double forms. Finally there come the abnormally long individuals, including hypertrophic specimens, unusually large dividing forms, incompletely divided organisms, and the multiple forms not infrequently met with in some cases."

The author then proceeds to employ this method in the identification of spirochaetes from the vagina, bladder, and pharynx in cases of human disease. The last part of the article, however, is more especially of veterinary interest and records observations on the intestinal spirochaetes of a number of the lower animals. Until quite recently, even the intestinal spirochaetes found in man had not been thoroughly studied, and with the exception of a few brief references the author was unable to discover any descriptions of the forms found in domesticated animals. [He appears to be unaware of the recent work of some American authors on the spirochaetes found in the intestinal tract and internal organs in pigs in cases of swine fever.- - Ed.]. Our lack of knowledge appears to be due to the fact that hitherto these spirochaetes have been assumed to be non-pathogenic. The spirochaetes found on the surfaces of ulcerated lesions have also been regarded as saprophytic, but in some cases there is evidence that the organisms may spread beyond the superficial lesions and even become blood parasites. In the course of examining blood films from the Accra slaughterhouse in 1914, spirochaetes were occasionally found, viz., in 4 out of 166 cattle, 4 out of 95 sheep, 1 out of 94 pigs, and 1 out of 80 goats. The parasites were of types found to occur in the intestines of these animals and they were always rare in the films. "The intestinal spirochaetes are sometimes present in such enormous numbers that one cannot but suspect that they are not entirely harmless. In man they are often most abundant in cases of diarrhoea, and they are certainly suspected of being directly connected with this condition."

Monkey. Small spirochaetes were found in great numbers in smears made from the large intestine and rectum of a monkey (*Cercopithecus petaurista*) that had died of amoebic dysentery at Accra. When stained by Leishman's method the spirochaetes appeared extremely slender but when stained with gentian violet they appeared rather thicker, about 0·2μ. The organisms were of the loosely-coiled type. The longest measured 9μ, the shortest 3μ, average 5·42μ. When plotted the measurements formed a curve similar to that of *S. eurygyrata*—recently shown by FANTHAM to constitute the single species invariably found in human faeces—and it was concluded that this spirochaete of the monkey was morphologically identical with the human species.

Rats. The faeces of a few healthy rats (*Epimys rattus*) were examined and spirochaetes were found to be numerous in some of the animals, scanty in others, but the species of parasite appeared to be the same in each case. The length of the organisms varied from 2μ to 11μ, average 5·27μ, and it was concluded that they could not be distinguished from *S. eurygyrata* by their morphological characters.

Sheep, cattle, goats, and pigs. A few spirochaetes from the faeces of these animals were measured. The average length was 4·7μ in sheep, 4·7μ in cattle, 5·5μ in goats, and 5·2μ in pigs. "Considering the small number of measurements made in each case, the lengths correspond fairly closely with each other and with those of rat spirochaetes and *S. eurygyrata*."

Dogs. In the faeces of an apparently healthy rough-haired terrier of European extraction an exceedingly heavy infection with minute spirochaetes was found. The same organism was also found in two native dogs. There was nothing characteristic about their movements, and structural details were difficult to observe on account of their smallness. Details are given with regard to the shape of the body and coils. The shortest length was 1μ, longest 5μ, average 2·7μ. The spirochaetes were slender organisms and even the thicker ones were less than 0·25μ broad. The ends were tapering and generally sharply pointed. This spirochaete appears to be a good deal shorter than that described by other authors in dogs, the species described by some resembling *Treponema pallidum*. The spirochaetes described by BALFOUR in the stomach and intestines of dogs dying of experimental trypanosomiasis in the Soudan appear to have been thicker, much more closely and regularly coiled, and longer. The author proposes the name *Spirochaeta canis* for the species described by him.

Cats. The faeces of four cats were examined and in three a very small number of small spirochaetes were found, and these appeared to be identical with those described above as occurring in dogs. In the fourth cat two different spiral organisms were found, the one in the stomach and the other in the large intestine and rectum. The organism found in the stomach was not of the *S. eurygyrata* type. It was a relatively thick organism, so closely coiled that it resembled a screw with a narrow thread; the average breadth was about 0·4 or 0·5μ and the length was from 3 to 8μ, average 5·48μ. This organism was believed to be the same as that found by BALFOUR in the stomach of a dog and referred to above. In the stomach of the same cat a great number of small delicate-looking spirochaetes with pointed extremities, morphologically indistinguishable from *S. eurygyrata*, were found.

The author's conclusions are as follows :—

"1. Spirochaetes of the *S. eurygyrata* type have been found in the faeces of certain of the lower animals examined at Accra.

"2. The first type was found in a monkey, a cat, rats, sheep, cattle, goats, and pigs, and appeared to be morphologically indistinguishable from *S. eurygyrata*, the species found in man.

"3. The second type, for which the name *S. canis* is proposed, was found in dogs and cats. This was a smaller organism, measuring most commonly 2μ to 3μ in length, and about 0·2μ in breadth."

AKATSU (Seinai) & NOGUCHI (Hideyo). **The Drug-Fastness of Spirochaetes to Arsenic, Mercurial, and Iodide Compounds** ***in vitro*.**—*Jl. Experim. Med.* 1917. Mar. 1. Vol. 25. No. 3. pp. 349–362. With 11 tables.

"It has been known for some time that in trypanosomiasis the trypanosomes which have survived the first effect of an arsenic germicide, such as atoxyl or arsacetin, offer a greater resistance to a subsequent dose of the same drug. By subjecting the organisms to repeated injections of an arsenic medicament, one tends to create, both in animals and in man, a strain or race which resists the arsenic chemotherapy to such an extent that the term arsenic-fastness has come into existence as a brief designation of the modified strain. A similar phenomenon has been observed in spirochetosis in fowls and mammals. Even with a typical bacterium, there seems to exist a possibility of raising the original resistance against a certain arsenic compound to a considerable degree, as was shown by Marks in his experiment with the paratyphoid bacillus, which he was finally able to cultivate in a medium containing eight times the amount of arsenious acid which the organism was able to withstand at the beginning of his experiment. Marks accomplished this within a period of three years by successive transplantations from a weaker to a gradually stronger concentration of the acid."

In this paper the experiments are directed mainly towards studying the effects of these drugs on the spirochaete of human syphilus, *Treponema pallidum*, but the results obtained are, however, of general interest. After enumerating the various methods of studying the sterilising effect of the preparations on this organism the authors state that the only practicable method is to determine the degrees of tolerance of pure cultures of *T. pallidum* to a given medicament by testing the organisms *in vitro* against gradually increasing doses of the drug. Details are then given with regard to the technique employed in carrying out this method.

The following is a summary of the results obtained.

"In the foregoing experiments we attempted to determine whether or not, by subjecting several varieties of spirochaetes to increasing doses of certain chemotherapeutic agents, a gradual increase of resistance to the latter could be shown. For this purpose, pure cultures of *Treponema pallidum*, *Treponema microdentium*, and *Spirochaeta refringens* were used against the action of salvarsan, neosalvarsan, bichloride of mercury, and iodine-iodide potassium solution *in vitro*. For culture media, the usual ascites-broth-tissue medium as well as solid ascites-agar-tissue medium was used. After permitting the spirochaetes to grow for a fortnight in media containing certain quantities of each drug, transfers were made from tubes showing various degrees of growth to the next series of tubes containing the same drug in still higher concentrations, and similar transfers repeated every two weeks. The results of the experiments may be briefly summarised as follows :—

"1. *Treponema pallidum* and *Treponema microdentium* have, within three to four months, increased their tolerance to salvarsan and neosalvarsan to five and one-half times their original mark. With *Spirochaeta refringens* the increase was about three times.

"2. Against the action of bichloride of mercury, the amount of increased tolerance of *Treponema pallidum* was about 35 to 70 times the original, while that of *Treponema microdentium* was about 10 times as much and was reached within 10 weeks. *Spirochaeta refringens* resisted 30 times the original dose.

"3. There was an unmistakable increase of resistance of these spirochaetes to the action of the iodine-iodide solution (Lugol's solution) when they were grown for several generations in fluid media containing the iodine solution, but the rate of increase between the initial and the acquired tolerance was slight. In general, the addition of Lugol's solution to fluid media has a weak inhibitory influence upon the growth of the spirochaetes, requiring for the total suppression of growth a quantity of over 0·7 c.c. to 5 c.c. of the culture media. The tolerance reached was for about three times that amount.

"4. A similar tolerance phenomenon has not been established when employing a solid instead of a fluid medium containing the drugs. No explanation is offered except a suggestion that the drugs held in the agar do not enter into combination with certain tissue constituents of the medium as they are able to do with tissue elements in fluid media. This may be a factor necessary for inducing drug tolerance in these organisms *in vitro*.

"5. The increased drug-fastness *in vitro* has a limit beyond which no further advance can be made. This limit varies with different species of spirochaetes.

"6. The acquired drug-fastness *in vitro* gradually disappears when the spirochaetes are cultivated again in the drug-free media for several generations."

Kolmer (W.) & Wagner (R. J.). **Ueber eine im Magenfundus des Hundes vorkommende saprophytische Spirochäte.** [A Saprophytic Spirochaete found in the Fundus of a Dog's Stomach.]—*Centralbl. f. Bakt.* I. Abt. Orig. 1916. Oct. 12. Vol. 78. No. 5. pp. 383–384. With 1 fig.

Within the gland follicles of the fundus of the stomach of an apparently quite normal dog the authors discovered a very large number of spirochaetes in pure culture, which apparently produced no visible lesion. . Histological examination also showed that there was nothing abnormal in the gland cells. The spirochaete was exclusively extracellular and occurred either singly or in tufts filling up the lumen of the follicles. It measured 10 to 12μ in length by about $0{\cdot}25\mu$ in breadth and always possessed 8 spirals, each of which was $0{\cdot}7\mu$ in depth and $1{\cdot}2\mu$ in length.

Reference is made of the discovery of spirochaetes (*Sp. regaudi*) in the normal stomach mucous membrane of dogs and cats by Regaud (1909). Ball & Roquet (1910), and Lucet (1910), described two kinds of spirochaetes in the stomach of a dog affected with gastroenteritis, viz., a slender actively motile spirochaete, 5 to 10μ by $0{\cdot}4\mu$, and another short thick form 4 to 7μ by $0{\cdot}8\mu$. These organisms were not discoverable in the blood. The spirochaete dealt with in this paper is stated to be quite different in appearance from those described by these authors.

(e) TRYPANOSOMIASIS.

Velu (H.). **La Trypanosomiase des chevaux au Maroc. (Etude expérimentale.)** [An Experimental Study of the Equine Trypanosomiasis of Morocco.]—*Bull. Soc. Path. Exot.* 1917. Mar. Vol. 10. No. 3. pp. 253–260.

Reference has already been made to the author's observations on the above disease [see this *Bulletin*, 1916, March. Vol. 4. No. 1. p. 10]; its frequency and distinctive clinical characters were described. Sergent, Lhéritier and Belleval (1911) gave the name *Trypanosoma marocanum* to the causal organism [*loc. cit.* 1915. Sept. Vol. 3. No. 3. p. 84].

The author summarises the results obtained by inoculating various animals with blood containing the trypanosome from six different horses. The effects of inoculation and of passage on the various animals are depicted in the form of a genealogical chart.

The following are briefly the author's conclusions.

The trypanosome appeared to be very virulent for the white rat. After an incubation period of about 3 to 4 days this animal showed an acute infection which lasted on an average from 7 to 10 days. On post-mortem examination the spleen was found to be enormously enlarged.

The rabbit appeared to be only slightly affected. The disease took on a chronic form which ran a protracted and irregular course. The symptoms and the lesions were the same as in the case of all other trypanosomiases in this animal.

A considerable number of dogs were inoculated and it was found that the disease in the dog was sub-acute in character with frequent febrile crises. The presence of the trypanosome almost constantly in the blood makes observation easy when dogs are used as experimental animals.

In the case of two mules the course of the disease was relatively rapid as compared with that of the natural affection.

Two goats and two sheep inoculated did not present any trypanosomes subsequently in the peripheral blood nor any symptoms besides attacks of fever and wasting in condition. The two goats recovered, one at the end of thirteen months and the other at the end of twelve months; the infection could only be placed in evidence by the incoulation of large quantities of blood into dogs.

GREGGIO (G.). **Trypanose des porcs; relations des porcs avec la trypanose humaine dans la vallée de l'Inkissi (Moyen Congo belge).** [Trypanosomiasis of Pigs. Relations between Pig and Human Trypanosomiasis in the Inkissi Valley, Middle Belgian Congo.]—*Bull. Soc. Path. Exot.* 1917. Feb. Vol. 10. No. 2. pp. 113–117.

In this article the author tabulates the results obtained on examination of smears from the blood of pigs brought to the Kisantu Market from various outlying districts from May to November, 1914. The trypanosome discovered was identified by RODHAIN as *T. congolense.*

The following were briefly the results obtained.

(1) Kisantu district (right bank of the Inkissi). Sixteen affected out of 50 examined, = 32 per cent.

(2) Tumba Mani district (right bank of the Inkissi). Fifteen affected out of 32 examined, = 46·8 per cent.

(3) District to the left of the Inkissi (opposite Kisantu). Five affected out of 12 examined, = 41·6 per cent.

This makes a total of 36 altogether affected out of 94 examined, = 38·3 per cent.

The following are, briefly, some of the deductions drawn by the author from these observations.

The infection has spread almost throughout the whole of the large valley of the Inkissi. The trypanosomes were very few in number in the blood. The trypanosomiasis causes no economic loss as the pigs show no external sign of disease and may be in very good condition.

There is no direct relationship between trypanosomiasis in pigs and in human beings in a certain district, and figures are given showing that the one may be very severe and the other almost entirely absent in a given place. Indirectly, however, serious dangers threaten the districts where pig-breeding has become extensive, on account of the fact that these animals favour the multiplication of Glossina and the most suitable places for rearing pigs are infested with the fly. In the district of Tumba Mani, for example, where pig-breeding has become very extensive, the villages are situated on the tops of hillocks surrounded by pastures consisting of short grass which makes it impossible for *G. palpalis* to propagate. The pigs kept in these villages are now able to find sufficient nourishment for themselves in the valleys and copses alongside the watercourses and are continually moving backwards and forwards to the huts in the villages, bringing along on their bodies a considerable number of *G. palpalis.* The percentage of total deaths due to sleeping sickness among the natives in these villages during the last few years has risen to 42·9 per cent., and the migration of *G. palpalis* on pigs appears to be the only explanation of this increase.

Mention is made of a similar occurrence in the Island of Principe, where, according to the Portuguese Commission on Sleeping Sickness, the role of pigs as carriers of *G. palpalis* was firmly established.

KOLMER (J. A.), SCHAMBERG (J. F.) & RAIZISS (G. D.). **Various Methods for determining the Trypanocidal Activity of Substances *in vitro* and their Relation to the Chemotherapy of Experimental Trypanosomiasis.**—*Jl. Infect. Dis.* 1917. Jan. Vol. 20. No. 1. pp. 10–27. With 15 tables.

—, — & —. **The Numeric Relationship of Infection to the Chemotherapy of Experimental Trypanosomiasis.**—*Ibid.* pp. 35–44. With 7 tables.

In the first of these papers the authors describe a series of rather elaborate methods for determining the toxicity of various chemical compounds on trypanosomes.

The first is called the microscopic method; a series of dilutions of the various compounds are added to blood containing trypanosomes obtained from white rats and the times required to kill the trypanosomes as observed by loss of motility and structural changes are determined by direct microscopic examination.

In the second method, which the authors call the "in-vitro-vivo centrifuge method," the trypanosomes are exposed for a certain interval to a definite dilution of the chemical, are then removed and washed by centrifugation and injected into the peritoneal cavities of white rats to determine whether their destruction has been brought about.

In another method called the "combined in-vitro-vivo method," equal parts of varying dilutions of the chemical under study are mixed with the blood trypanosome emulsion and kept at 37° to 40° C, and then the whole or a part of each is injected intraperitoneally into white rats to determine the degree of trypanocidal activity. As a part of the drug is injected the action of the drug is both in-vitro and in-vivo and due care must be exercised against the administration of lethal doses of the drug.

The most suitable trypanosome for use in the inoculation of rats for these experiments was found to be *T. equiperdum.* The results are displayed in a series of tables; the conclusions are as follows:—

"Trypanocidal tests in vitro have been found of distinct value in chemotherapeutic researches in experimental trypanosomiasis.

"Substances exerting a profound trypanocidal activity in vitro are likely to prove trypanocidal in vivo, provided the drug is sufficiently non-toxic to be administered in adequate dosage.

"With the combined in vitro-vivo method described herein, it has been found possible to detect the trypanocidal activity of new compounds which were without effect in vivo in amounts but slightly less than the sub-lethal dose.

"By the methods described herein arsenobenzol, or salvarsan, has been shown to possess a high trypanocidal activity in vitro.

"In vitro methods have also demonstrated a trypanocidal activity on the part of mercurials which is not apparent in the in-vivo tests."

In the second paper the method of study employed consisted in inoculating rats intra-peritoneally with a certain number (100,000 to 150,000 per rat) of *T. equiperdum* 24 hours before various doses of the drug were administered intravenously. The parasites were not usually found in the peripheral blood until 48 hours after injection or 24 hours after treatment. In this manner the infection was given a 24 hours start and was heavy enough to infect the controls in every instance, yet light enough not to mask finer degrees of therapeutic effect on the part of the drug under study. The conclusions are as follows:—

> "These experiments demonstrated that in the chemotherapy of trypanosomiasis there is an important relationship between the number of trypanosomes injected into the test animal and the trypanocidal activity on the part of the drug.
>
> "This relationship is particularly in evidence with respect to the amount of the drug necessary to effect complete sterilisation; while rats infected with 500,000 trypanosomes may be sterilised with 0·001 gm. of arsenobenzol per 100 gm. of rat, this is not the case when larger numbers of trypanosomes are injected.
>
> "The influence of numbers is less marked when the rats are very heavily infected, as with numbers over 2,000,000. In these instances, arsenobenzol or salvarsan in dose of 0·001 gm. or 0·6 gm. per 60 kilogrammes of body weight retards the appearance of trypanosomes in the peripheral blood, but does not sterilise. The time of appearance of the parasites in the blood is likewise not greatly influenced by variation in the number used in inoculation.
>
> "The numeric relationship of infection to the results of chemotherapeutic experiments is therefore of considerable importance, and more particularly in comparative tests."

Rieckenberg (H.). **Eine neue Immunitätsreaktion bei experimenteller Trypanosomen-Infektion: die Blutplättchenprobe.** [A New Immunity Reaction in Experimental Trypanosomiasis: The Blood Platelet Test.]—*Zeitschr. f. Immunitätsforsch. u. Exper. Therap.* 1917. Jan. Vol. 26. No. 1. pp. 53–64. With 3 tables.

The technique employed is as follows.—

Rats are infected with a certain strain of nagana obtained from mice and when the trypanosomes in the blood are fairly numerous the rat is restored to health by the administration of tartar emetic, arsenophenylglycin, trixidin, etc. Three or four days after recovery a drop of blood from this rat is mixed with a drop of 2 per cent. citrate broth on a glass slide, and some trypanosomes of the original strain from a mouse are added quickly and well mixed, covered with a cover glass, and then examined under a high power dry objective.

The author claims that in addition to the usual phenomenon of agglutination one observes in such cases as this in about 15 or 20 minutes that the blood platelets become gradually attached to the trypanosomes, especially on the flagella; translatory movements are first inhibited and then the trypanosome becomes more and more immobile. A considerable mass of blood platelets is finally seen on the trypanosome when its movements have entirely ceased.

The author was able to show that certain free-lying platelets in the preparation belong to the non-immune mouse.

The serum obtained from the blood of such an immune animal when mixed with the trypanosomes and blood of another animal gave no blood-platelet reaction, but showed the usual agglutination reaction.

This blood platelet reaction was further shown to be different from the agglutination reaction inasmuch as the latter could be produced by the addition of the serum of a normal horse whereas no blood platelet reaction could be obtained in this way. The author then details at length experiments with a number of nagana strains maintained in German laboratories; tests on guinea-pigs, rats, and mice showed that the reaction was distinctly specific for each strain and also for each of the recurrent strains.

"In the blood of animals infected with experimental trypanosomiasis and afterwards cured or of animals subject to a chronic laboratory infection, antibodies are found which manifest themselves by the fact that rat or mouse trypanosomes in the citrated blood of these animals become loaded with blood platelets.

"This phenomenon is strictly specific for it only appears if a homologous strain of trypanosomes is employed in the test.

"By this test one can differentiate between the original and the recurrent strain. The reaction appeared in all cases in which an immunity against re-infection occurred."

RITZ (H.). **Ueber Rezidive bei experimenteller Trypanosomiasis. II. Mitteilung.** [Recurrent Infections in Experimental Trypanosomiasis. Second Report.]—*Arch. f. Schiffs- u. Trop.-Hyg.* 1916. Sept. 1. Vol. 20. No. 17. pp. 397–420. With 5 tables.

After discussing the significance of recurrent infections in trypanosomiasis according to various authors, Ritz details the technique employed by him in studying the various strains of trypanosomes produced in the course of recurrent attacks following infection by a single pure strain.

A rabbit was inoculated intravenously with a small quantity of blood from a mouse containing *T. brucei*, PROWAZEK strain, which had been isolated and maintained in mice in a pure state according to OEHLER's method.

On microscopic examination of this rabbit's blood a few trypanosomes were observed on the first three days after infection, on the 10th to the 12th day inclusive, and again in increasing numbers from the 24th to the 29th day, when the animal died.

Mouse inoculation was performed daily from the rabbit's blood. These gave positive results every day except on the 5th day after infection. The strains obtained on the first four days after infection and again on the nine days following the temporary disappearance of trypanosomes from the blood were kept running separately in mice and employed, together with the original strain used for infecting the rabbit, in a series of reciprocal cross-immunity tests on mice.

The mice used in these tests were infected intraperitoneally with the strain to be examined and then on the third day, when trypanosomes were numerous in the blood, cured by means of an intravenous injection of neosalvarsan. The trypanosomes having then disappeared from the blood the mice were re-infected with the other strains to be tested and the subsequent absence of trypanosomes from the blood or a long-delayed infection indicated immunity, or the identity of the two strains inoculated into the mouse.

In the case of rabbits the author divides the clinical course of infection into three stages, viz., the initial stage, which commences immediately after infection and lasts three or four days, secondly the crisis, during which the trypanosomes may disappear completely from the blood for up to three days as shown by mouse inoculation, and thirdly, the recurrence or the relapse, when the trypanosomes can be demonstrated daily up to death.

By means of the mouse cross-immunity tests it was found that trypanosomes which appeared during the initial stage were identical with each other, and with the original strain.

The results, however, obtained in the tests with recurrent strains are very complicated. The first, third, fourth, fifth, seventh, and ninth day recurrent strains were tested against each other and against the original strain. The results as shown in the tables are briefly as follows :—

Mice immune to the original strain showed no immunity towards any of the recurrent strains.

Mice immune to the first day recurrent strain showed no immunity towards the original or any of the other recurrent strains except that a slight delay in infection was noticeable in the case of re-infection with the third day strain.

Infection with the third-day recurrent strain produced immunity against itself and the first day strain and a slight delay in the case of the fourth day and fifth day strains, and negative results towards the original and the other recurrent strains.

Infection with the fourth day recurrent strain produced immunity against itself and the first day strain and a slight delay in the case of the third, fifth, and seventh day recurrent strains.

Infection with the fifth day recurrent strain produced immunity against itself, the first and the sixth day strains only.

Infection with the seventh day recurrent strain produced immunity against itself and the first day strain and a slight delay in the case of the second day strain.

Infection with the ninth day recurrent strain produced immunity against itself only, and a slight delay in the case of the seventh day strain.

Control mice inoculated with these strains died in all cases on the fourth or fifth day after infection.

The author enters into a long discussion on the significance of these results. His views are briefly that changes take place analogous to those in which "drug-fast" trypanosomes are created. Owing to trypanosome-immune bodies which tend gradually to destroy the strain or strains of trypanosomes present being produced in the serum of the infected animal, "serum-fast" forms are continually appearing and these new strains show different properties to the original strain and to the forms previously formed during the recurrent attack. In the course of a recurrent attack there are thus continually produced in the blood a very large number of new "serum-fast" strains which are probably responsible for the ultimate death of the animal.

Schuscha (A. T.). **Ueber die Wirkung von Emetinum hydrochloricum auf Trypanosomen.** [The Action of Emetine Hydrochloride on Trypanosomes.]—*Cent. f. Bakt.* 1. Abt. Orig. 1917. Mar. 31. Vol. 79. No. 4. pp. 180–183. With 5 tables.

In view of the apparently specific action of emetine in amoebic dysentery, the author performed a few experiments to ascertain whether the drug had the same effect upon trypanosomes. In these experiments mice were inoculated with a strain of *T. equiperdum* which ordinarily produced death in from 7 to 14 days. The toxic dose of emetine was found to be about 0·002 gramme per mouse.

A sub-lethal dose (0·001 gramme) injected on the third day after infection, when trypanosomes first appeared in the blood, was found to have no curative effect, although death occurred in the treated animals two or three days later than in the case of the controls.

Even when injected early, that is, before the appearance of trypanosomes, the drug failed to prevent death. Death, however, was delayed for about ten days when the drug was administered on the day following the inoculation, and approximately the same results were obtained when the drug and the trypanosomes were injected simultaneously.

The author concludes that emetine hydrochloride has only a small protective action on mice after infection subcutaneously with trypanosomiasis (*T. equiperdum*). A curative action, as in the case of amoebic dysentery, does not exist; the action of the drug on the latter disease appears to be quite specific.

SWEZY (Olive). **The Kinetonucleus of Flagellates and the Binuclear Theory of Hartmann.**—*Univ. California Publicat. Zool.* 1916. Mar. 16. Vol. 16. No. 15. pp. 185–240. With 58 text figs.

"Summary.—1. The 'kinetonucleus' is a structure which, in the trypanosomes at least, is not composed of nuclear chromatin, nor can nuclear behavior, shown in mitosis, be claimed for it. It is a structure correlated with an endoparasitic mode of life, and is part of the extranuclear motor apparatus, which, in those cases where its origin can be traced, arises from the blepharoplast, and not by a division of the nucleus.

"2. The 'kinetonucleus' has been developed phylogenetically along two lines: first, from a uniflagellate ancestor possessing a simple basal granule, producing *Trypanosoma, Crithidia* and *Herpetomonas*; second, from a heteromastigote ancestor, also exhibiting only a simple basal granule, along the line of *Prowazekia, Polymastix, Trichomonas,* and the Trichonymphida.

"3. The chromidial body of *Prowazekia* arises as an outgrowth from a simple basal granule. Different stages in its development can be traced from this condition to the 'kinetonucleus' of *P. cruzi*, followed by its backward migration to a position posterior to the nucleus. The various forms which it assumes are all different aspects of the same structure, morphologically and functionally equivalent to the 'kinetonucleus' of the trypanosomes.

"4. The next stage in the development of the 'kinetonucleus' has produced, by a course of parallel evolution along two different lines, organelles in *Polymastix* and *Trypanoplasma* similar in their morphology and behavior in division. These are accessory kinetic structures comparable to the 'kinetonuclei' of the haemoflagellates.

"5. A slight modification of the long, band-like 'kinetonucleus' of *Prowazekia lacertae* is found in the chromatic basal rod of *Trichomonas*. This is an accessory structure intimately related to the blepharoplast and the entire neuro-motor apparatus and probably kinetic in its function, and hence an organelle homologous with the 'kinetonucleus' of the trypanosomes.

"6. A further development of the 'kinetonucleus' is found in the parabasal bodies of the Trichonymphida, a group phylogenetically close to *Trichomonas*. These bodies are accessory kinetic structures and in every respect comparable with the same organelles found in the other flagellates.

"7. This structure is not the kinetic center of the cell, but is an accessory part of the motor apparatus, a kinetic reservoir, hence the term 'kinetonucleus' denotes a wrong interpretation of its function, as does also the name blepharoplast, which is reserved for the definitive basal granule of the flagella plus the centrosome in some cases at least. As a more appropriate substitute for these names, and one which better indicates its probable relations in the cell, is suggested the term 'parabasal body,' first proposed by Janicki for these organelles in the Trichonymphida. Its application is here considerably extended.

"8. The binuclear theory of Hartmann and the foundation of the order Binucleata, rest upon three main propositions, namely, that the 'kinetonucleus' is composed of nuclear chromatin, that it originates by division of the trophonucleus, and that it divides by mitosis. These facts are contradicted by the results of careful investigations on both the Haemoflagellata and Haemosporidia, where these conditions are claimed to occur, which show, (i) by actual experimental proof, that the 'kinetonucleus' is not composed of nuclear chromatin, (ii) that in no single instance has it been found to arise by division of the nucleus, and (iii) that in no instance has a process of mitosis been found which could be correlated with division of the other organelles and with the cell.

"9. The Haemosporidia are affiliated with the Haemoflagellata neither morphologically nor by a comparison of the developmental data of the two groups. On the contrary, they are more nearly allied to the Coccidia and should be retained therewith in the Sporozoa.

"10. The order Binucleata, being founded on false premises and composed of families totally unrelated either morphologically or phylogenetically, should not be retained as a valid order of the Mastigophora."

(f) MISCELLANEOUS.

LEGER (Marcel). **Observations sur quelques Leucocytozoon d'Oiseaux de la région de Reims.** [Observations on Some Leucocytozoa of Birds in the Neighbourhood of Rheims.]—*Bull. Soc. Path. Exot.* 1917. Jan. Vol. 10. No. 1. pp. 28–33.

(1) Leucocytozoon parasites appear to be very common in the blood of crows (*Corvus corax*). Out of 15 birds examined 12 were found affected, for the most part intensely. The infection appears to be very severe in nestlings. The Leucocytozoon is of a rounded type measuring from 12–14μ in diameter and has an oval nucleus which nearly always contains at its thinner extremity a rod-shaped or spherical kinetonucleus. The nucleus of the invaded cell usually forms a crescent embracing in its concavity more than half the haematozoon. The author found that the host cell was a mononuclear leucocyte and was able to prove that the red corpuscles were not invaded, as insisted upon by some authors, by pouring the blood into slightly acidulated water.

Small oval or elongated elements were seen measuring from 1 to 2μ, containing a relatively large red-stained nucleus surrounded by the blue-stained protoplasm. These were richest in the lungs and bone marrow. The next forms, which had grown from 2·5 to 4μ, were found adherent to a depression in the nucleus of the host cell. The growth of the parasite is then very rapid and the nucleus is pushed towards the periphery of the cell but is not disintegrated.

The formation of microgametes was observed when blood had been collected in a solution of potassium oxalate; although this could not be observed in pure blood. The liberated flagella were found to be very active.

In the bone marrow of crows certain forms were observed which seemed to belong to the multiplicative stage of Leucocytozoon.

(2) Leucocytozoon were also frequently found in the common magpies of the Champagne district (*Pica melanoleuca*). The parasite was identified with *L. berestneffi* Sambon, 1908, described by SAKAROFF in Transcaucasian magpies, 1893.

(3) A Leucocytozoon parasite was also found in a screech owl (*Asio accipitrinus*), and the author believes that this parasite is identical with *L. ziemanni* Laveran, 1902.

YAKIMOFF (W. L.) & SAPHRONOWITSCH (R. A.). **Parasites du sang des animaux en Transcaucasie.** [Blood Parasites of Animals in the Transcaucasus.]—*Bull. Soc. Path. Exot.* 1917. Feb. Vol. 10. No. 2. pp. 98–100.

(1). Grahamella in rodents of the Caucasus.—This protozoon was found in the blood of a hamster (*Cricetus phoca*) and in a species of field mouse. In stained specimens the parasites appear as rod-shaped organisms measuring from 0·75 to 1·5μ, variable in number, but sometimes very numerous, and staining a violet-blue colour. No visible ill-effects were produced on the hosts. Anaplasms were also observed in the field mouse. The name *G. ninae kohl-yakimovi* is given to the parasite of the hamster.

(2). Theileria in the field mouse.—The blood of several of these animals in the district of Kars was examined and in all presented distinct polychromatophilia, but no poikilocytosis or normalblasts. In one case the authors discovered small rounded intra-corpuscular elements each consisting of protoplasm staining blue and a peripheral nucleus occupying nearly half the parasite. No pear-shaped or rod-shaped elements were observed. These bodies are identical with similar forms found previously by Yakimoff. The name *Theileria rossica* is given to these elements.

(3). Leucocytogregarina of a fish.—Gregarines have recently been frequently discovered in the leucocytes of mammals, but none have hitherto been described in the leucocytes of fishes although they have been found on several occasions in the red corpuscles. In the fish examined the gregarine was found inside a large mononuclear; it measured 9μ by 4·5μ and possessed one rounded and one elongated pointed extremity. The name *Leucocytogregarina ninae kohl-yakimovi* is given to this parasite.

LEGER (M.) & MOUZELS (P.). *Plasmodium* **de** *Iguana nudicollis.*—*Bull. Soc. Path. Exot.* 1917. Feb. Vol. 10. No. 2. pp. 95–98.

The small lizards of the species *Iguana nudicollis* Cuvier found in Guiana are often observed to harbour a Plasmodium which invades the red blood corpuscles without producing in them any deformity or change in the staining reactions. A single corpuscle may contain two or three parasites.

Asexual elements.—The youngest form, which is also the form most commonly found, consists of a minute body scarcely 1μ in diameter made up almost entirely of a nucleus containing a brightly staining karyosome towards its periphery. The growing stage presents a variety of appearances—ring-shaped, sometimes pear-shaped, dumb-bell-shaped, rod-shaped, etc.—and often containing in addition to the nucleus a very dense coarse chromatin particle staining garnet-red. The adult form becomes amoeboid or lozenge-shaped and never exceeds 5μ in diameter. The nucleus usually disappears and the chromatin forms a diffuse network in the protoplasm and later becomes divided into three or four small masses placed towards the periphery of the parasite. The above forms rarely show any pigment granules. Segmentation of the schizonts never takes place in the circulating blood but can be observed in the organs, especially in the lung. These dividing forms are found outside the corpuscles, and are regularly rounded in appearance, measure from 5 up to 7μ, and contain an abundance of dark brown pigment. Schizogony thus takes place with the formation of four merozoites.

Sexual elements.—The gametes are fairly numerous in smears from the organs especially from the spleen but are extremely rare in the peripheral blood. They are always outside the corpuscles. Macrogametes are rounded or oval, from 3·5 to 6μ in diameter with a centrally placed chromatin mass and contain a very abundant black irregular mass of pigment. The microgametocytes are rather smaller in size and the nucleus is made up of loose lightly staining chromatin; the pigment is made up of greenish-brown short rods.

A form believed to be a female element undergoing parthenogenesis is also described. No periodicity was observed in the schizogonic cycle when the blood was examined for several days. Reference is made to other species of plasmodium found in lizards by CARINI, WENYON, and other observers, but the parasite described in this paper is said to bear a close resemblance to *Pl. praecox* found on the West Coast of Africa and *Pyrhemocyton tarentolae* Chatton & Blanc. The name *Pl. carinii* is proposed for this new species.

YAKIMOFF (W. L.). *Prowazekia ninae kohl-yakimovi—Bull. Soc. Path. Exot.* 1917. Feb. Vol. 10. No. 2. p. 101.

This protozoon was discovered in infusions of hay from various parts of Russia. It possessed one principal nucleus, a blepharoplast, and an anterior and a posterior flagellum, each with one or more basal granules. The parasite was cultivable on Frosch's and Musgrave and Clegg's agar.

YAKIMOFF (W. L.) & SCHOKHOR (N. J.). *Leucocytogregarina musculi* **A. Porter à Pétrograde.**—*Bull. Soc. Path. Exot.* 1917. Feb. Vol. 10. No. 2. pp. 100–101.

A leucocytogregarine was discovered by PORTER (1908) in mice in London and later by SANGIORGI (1912) in Turin.

This parasite was found by the author in smears from the organs of a mouse at Petrograd, and he believes it to be identical with the organism described by PORTER and SANGIORGI.

DISEASES DUE TO METAZOAN PARASITES.

YAKIMOFF (W. L.) & Collaborators. **Microfilaires des animaux au Turkestan russe.** [Microfilariae of Animals in Russian Turkestan.] —*Bull. Soc. Path. Exot.* 1917. Feb. Vol. 10. No. 2. pp. 102–105.

Reference has already been made to microfilariae described by the authors in horses, asses, mules (*Microfilaria ninae kohlyakimovi*), and camels (*Mf. camelensis*). [See this *Bulletin,* 1916. June. Vol. 4. No. 2. p. 69.] In this article microfilariae are described in the following species of animals.

(1). *Dogs.* The blood of 597 dogs from various districts was examined and 61 were found infected (10·21 per cent). The monthly infection was as follows :—March, 4 per cent, April, 4·1 per cent., and May, 14·1 per cent. The parasite measured from 245·44 to 333·70μ in length, by 7·16 to 8·52μ in breadth. It had the same appearance as microfilariae in other animals except that the sheath could not be stained. It usually contained five clear spots. A description is given of the internal structure of the parasites and differential blood counts of the host. The microfilaria is stated to be identical with *Mf. immitis.* Sometimes adult filariae were found in the heart and large blood vessels. The intestinal contents of Hippoboscidae caught on the dogs disclosed microfilariae.

(2). *Bovines.* Examination of the peripheral blood of 316 animals at the slaughterhouse failed to disclose any microfilariae. The affected seat was, however, later found to be the liver. Examination of the peripheral blood of a further series of 1,019 animals revealed filarial embryos in two cases. In the livers of 510 animals examined the parasites were found in 43 cases (8·4 per cent.). The sheath of the parasite stained very well. It contained 3 clear spaces. Its measurements, including the sheath, were on an average 250μ in length by 8·25μ in breadth. Sometimes smaller parasites were found resembling the sausage-like stage of *Filaria bancrofti* in the thoracic muscles of *Culex fatigans* (Low). The parasite is believed to be identical with the embryo of *Filaria labiato-papillosa.*

No microfilariae were found in the peripheral blood of 1,173 sheep and 671 ewes, and in 106 sheeps' livers.

(3). *Frogs.* Small microfilariae were found in the blood of *Rana viridis.* The sheath was well developed and stained red. Including the sheath they measured on an average 46μ by 4·24μ. They contained closely packed nuclei.

Leger (André). **Microfilaires d'oiseaux du Sénégal.** [Microfilariae of Birds in Senegal.]—*Bull. Soc. Path. Exot.* 1917. Feb. Vol. 10. No. 2. pp. 106–109.

After reviewing the list of microfilariae already found in the blood of many species of birds in several parts of the world, especially in Africa, the author describes three new species discovered by him in the following birds in Senegal. The adult forms of the embryos were not discoverable.

(1). The Giant Heron (*Ardea goliath* Temminck).—The microfilariae found in this bird were surrounded with a compact sheath, measured on an average 220 by 3·5μ, contained several distinct nuclei, and possessed active wriggling but only slight translatory movements. The caudal extremity was hook-shaped and the posterior end blunted. The parasite showed no periodicity, and it apparently had no ill effect upon the health of the host.

(2). Snipe (*Gallinago nigripennis* Linné).—The microfilaria was very rare in the blood. It measured 130 by 14μ, contained distinct cellular nuclei, was surrounded by a compact sheath showing no striation of the cuticle, and the posterior extremity was elongated and slender; it presented only slow creeping movements.

(3). The Large White-Throat (*Crateropus platycercus* Swainson).—In one bird examined an extremely severe infection was found (from 7 to 10 per field of the microscope). Morphologically these were found to belong to two different species.

The first was very closely ensheathed, measured 250 by 5·5μ, and presented very little activity, its movements being rather leech-like; it contained packed distinct nuclei, its posterior extremity was bulbous and the central clear spot was very apparent.

The second microfilaria was much smaller in size (80 by 5·5μ) and much less numerous in the blood (1 to 25 or 30 of the former). It was not ensheathed and it exhibited extremely rapid translatory movements. The cellular nuclei were indistinct, there was no striation of the cuticle, and the posterior extremity was blunted.

CLELAND (J. B.), DODD (S.) & FERGUSON (E. W.). **Further Investigations into the Etiology of Worm Nests in Cattle due to** ***Onchocerca gibsoni.*** **No. 2.**—*Commonwealth of Australia Publication.* 41 pp. Melbourne: Albert J. Mullet, Govt. Printer.

The investigations forming the subject of this communication are a continuation of those previously carried out in the State of New South Wales; details of previous experiments carried out by Cleland in conjunction with various authors have already been published in Government Reports commencing in July, 1913. The experimental work was carried out at Milson Island where conditions appeared favourable for work on account of the natural infestation with worm nests of the herd of cattle kept on the Island. From previous experiments carried out in this locality it seemed very clearly indicated that the vector was a flying insect, and that it probably was either *Stomoxys calcitrans* or one or more species of mosquito or of tabanids. The preponderance of evidence seemed to be in favour of Stomoxys and special attention was thus directed to this insect.

Three fly-proof cages for the accommodation of susceptible clean calves were erected and full details are given with regard to these structures.

Into one of these cages were placed two calves following each other at about three months interval; large numbers (about 11,000) of Stomoxys that had fed on infected cattle or on worm nests from the abattoir were introduced at short intervals over a period of three and six months respectively for the first and second calf. Notwithstanding the feeding of such large numbers of Stomoxys, of which some at least would be infected with Onchocerca larvae, it was found on slaughter that neither of these calves contained worm nests.

A similar experiment was simultaneously carried out in order to ascertain the rôle of mosquitos as possible vectors. Large numbers (over 2,000) of mosquitoes nearly all belonging to the species *Culicelsa vigilax*, and a few *Scutomyia notoscripta*, *Culicelsa annulirostris*, and *Stegomyia atripes*, were fed first on infected material as above and then introduced at various short intervals into the fly-proof cage. No worm nests were discoverable in these calves on post-mortem examination.

In the adjoining fly-proof cage one control calf was kept during these experiments and a few tabanids caught on infected cattle introduced. No worm nests were subsequently discoverable on slaughter.

Another control calf was kept in a pen where it was exposed to the attacks of flies and also to direct contact with the infected cattle. After nearly a year this calf was killed and on careful search a small worm nest was detected near the sternum, under the oblique muscles over the abdomen. A detailed account of the flies prevalent at various times during this exposure are given.

A further series of miscellaneous experiments with various diptera were performed.

Experiments to test the life of the larvae from worm nests placed in cow dung showed that they were not capable of surviving for 24 hours. Owing to the short life of the larva outside the body and also in view of the fact that no permanent natural water existed on the island it seems improbable that a water or moisture dwelling invertebrate is the intermediate host.

Transmission by the inbibition of secretions could only be effected by some species of Musca which are in fact extremely numerous on cattle in Australia. The life of the larval worm is, however, extremely short in these insects and no larvae have been found round the eyes, nostrils, and mouths of cattle where these flies commonly settle. In connection with the possible transmission by biting insects or other invertebrates the incidence and description of a long series of flies are enumerated.

The source through which *Onchocerca gibsoni* was introduced into Australia has previously been discussed by CLELAND and HARVEY JOHNSTON, who suggested that it had been introduced with buffaloes into the Northern Territory of Australia, and GILRUTH and SWEET, who considered that it had been introduced by means of ordinary cattle from Java or some other of the Malay Islands. The authors now state that "a further consideration of the sources from which cattle were imported into Australia in the early days of settlement, together with greater detail as to the distribution of worm nests in cattle in New South Wales, has made us reconsider both these possibilities and we have now come to the conclusion that it is by no means improbable that *Onchocerca gibsoni* reached Australia amongst the early importation of cattle from India into the neighbourhood of Sydney and from this source spread northwards with the distribution of cattle."

With regard to the probable vector the authors conclude that it is unlikely to be Stomoxys or mosquitoes but that it is probably some tabanid; the distribution of onchocerciasis seems to correspond with the prevalence of tabanids. Details regarding infested cattle on Milson Island conclude the paper.

VAN SACEGHEM. **Dermatose et gale démodectique des bovidés.** [Dermatitis and Demodectic Mange of Bovines.]—*Bull. Soc. Path. Exot.* 1917. Feb. Vol. 10. No. 2. pp. 117–120.

The dermatitis which occurs among bovines in the tropics and is caused by *Dermatophilus congolensis* is often confused with bovine demodectic mange. These two skin affections are, however, easily distinguishable bacteriologically and clinically.

Demodex folliculorum var. *bovis* is characterised by the length of its rostrum and cephalothorax, which is almost equal to that of the abdomen. It was first described by GROS (1845), by FAXON (1878) in America, and GRIMM and OEHL in Germany.

The lesions produced by the demodex in Europe are mild, but in South America on the other hand losses are caused on account of the diminution in value of the hide.

GRIFFITHS (1915) describes severe lesions caused by the Demodex in bovines in Nyasaland.

A large number of cases of demodectic mange were observed by the author in the Belgian Congo both among European and native breeds as well as in Indian hump-backed cattle. The disease is characterised by the following clinical symptoms :—

(1) The presence of comedos from the size of pins' heads up to hens' eggs containing brownish matter, and no crusts; (2) the chronic and slowly progressive character of the disease; (3) no effect on the general condition; (4) young animals not affected; (5) occurrence in the dry season as well as in the rainy season in the tropics.

The spread of the disease was prevented by regular dipping in arsenical baths (sodium arsenite, paraffin, soap, and water).

Dermatophilus congolensis, the cause of tropical dermatitis in bovines, is a filamentous bacterium and appears in two forms (1) straight or curved filaments, sometimes branched and containing fine granules, (2) isolated cocci.

The disease is identified clinically by the following characters (1) the formation of crusts, the hairs over which are erect; (2) rapid spread over the animal; (3) complications which may bring about death; (4) young animals and adults affected to the same degree: (5) a seasonal affection which is only seen in the acute form during the rainy season. The specific treatment for this disease consists in the application of an ointment made of 5 per cent. carbolic acid in vaseline.

The two diseases may exist at the same time on one animal.

HADWEN (S.) & BRUCE (E. A.). **Anaphylaxis in Cattle and Sheep, produced by the Larvae of *Hypoderma bovis*, *H. lineatum* and *Oestrus ovis*.**—*Jl. Amer. Vet. Med. Assoc.* 1917. Apr. Vol. 4. No. 1. pp. 15–44. With 15 figs.

The results of numerous interesting experiments described in this paper are briefly summarised by the authors as follows :—

"Anaphylaxis has been reproduced in cattle, sheep, and small animals, with extracts of the larval forms of *H. lineatum*, *H. bovis*, and *Oestrus ovis*.

"The 'acute and chronic' forms have been reproduced, coinciding with Richet's definition.

"The reactions can be induced by crushing and returning an extract of an animal's own larvae into the jugular, showing that larvae living in the animals make them receptive.

"Natural cases of anaphylaxis are described where no injection had been given, and where injury had ruptured the larvae subcutaneously, liberating their contents in sufficient quantity to produce shock.

"A paper by Ries is reviewed in which the author ascribed the cause of infectious anaemia as being due to *Gastrophilus* sp.: it seems probable that he was dealing with reactions such as we describe.

"Animals which had recovered from the reaction were found to be immune for varying periods.

"The symptoms in 'acute' anaphylaxis were immediate; the first noticeable sign being an extremely tired look, succeeded almost immediately by salivation, tears and defaecation, then by signs of asphyxia, and death. In the 'chronic' form the symptoms were a little less rapid and not so severe, in addition there were edemas especially of the eyelids and anus, and marked irritation of the skin.

"Small animals were sensitized with warble extracts and showed signs of anaphylaxis following the second injection.

"Eye and other local reactions were obtained with extracts applied to the mucous membranes. In cattle the reaction was specific for extracts of *Hypoderma,* and in a horse for *Gastrophilus.*

"It would appear probable that similar reactions will be obtained in other animals with their own parasites."

RODHAIN (J.) & BEQUAERT (J.). **Matériaux pour une Etude Monographique de Diptères parasites de l'Afrique. Deuxième partie. Révision des Oestrinae du Continent Africain.**—*Bull. Sci. France et Belgique.* 1916. Nov. 25. Vol. 50. Nos. 1–2. pp. 53–165. With 29 figs. & 1 plate. [Reprinted from *Rev. App. Entom.* 1917. Apr. Vol. 5. Ser. B. Pt. 4. pp. 49–50.]

"This paper deals with the sub-family Oestrinae, which, in the authors' opinion, does not correspond entirely with the intestinal *Oestridae* of Brauer. They exclude the genus *Aulacephala,* Macq., of which the larval stages are unknown and which appears to be more closely allied to *Trixa,* B. B., as well as *Cephenomyia,* Latr., and *Pharyngomyia,* Schin., which they place, as does Girschner, in the Calliphorinae. The chief characters of the larva at the third instar, the pupa and the imago of the Oestrinae are given. On these characters this sub-family would include only the genera *Oestrus.* L., *Cephalopsis,* Towns., *Rhinoestrus,* Br., *Kirkioestrus,* R. and B., and *Gedoelstia,* R. and B. The authors consider a classification based on the characteristics of the larvae can be only a provisional one and is justified only where the adult insect is unknown. These genera form a homogeneous group and might reasonably be treated as sub-genera of a single genus *Oestrus,* L. The distribution of the spines in the larvae at the third instar are not considered to have more than a minor value in classification, as they are probably very variable in different individuals at the same stage in any given species.

"The larvae of the Oestrinae are parasitic in the sinuses of the bones of the skull of various wild and domestic mammals and have been met with accidentally in man. In the latter case they never attain their full development and, when present, are usually localised in the eyes, in which they cause conjunctivitis. Since the cavities of the skull communicate with each other and also with the throat, these larvae may occur in the pharynx and larynx, and have even been found in sheep in the bifurcation of the trachea down to the large bronchial tubes. This often occurs after the death of the host, but probably never does so in the living animal. In antelopes several larvae of different species are usually found at the same time. The larvae of *Oestrus, Gedoelstia,* and *Kirkioestrus* are found only among the hollow-horned ruminants, those of *Rhinoestrus* among the equines, pigs and hippopotamus, while those of *Cephalopsis* are peculiar to the camels. Information as to the different species and their respective hosts is given in detail in a table.

"The mode of nutrition of these larvae is not well known, but it is to be supposed that they feed on the mucus of the passages in which they are found. The importance of breeding them is emphasised, though hitherto all attempts to rear them to the adult stage in captivity have failed. The adult flies will not feed or pair in captivity.

"An account is given of the organism, *Herpetomonas oestrorum,* which parasitises these larvae. Six larvae of *Rhinoestrus nivarleti,* R. and B., taken from the same individual of *Potamochoerus porcus,* L., were all parasitised by a flagellate closely resembling and perhaps identical with this.

"A key to the genera of the Oestrinae is given and descriptions with discussions on synonymy, hosts, and geographical distribution of the following species:—*Cephalopsus titillator*, Clarke, *Oestrus ovis*, L., *O. aureoargentatus*, R. and B., and *O. variolosus*, Lw., *O. macdonaldi*, Ged., *Rhinoestrus nivarleti*, R. and B., *R. hippopotami*, Grünb., *R. purpureus*, Brauer, *R. phacochoeri*, R. and B., *Gedoelstia cristata*, R. and B., *Kirkioestrus surcoufi*, Ged., *K. blanchardi* and *K. minutus*, R. and B.

"A bibliography of 46 works is given."

Piot (J. B.). **Maladie des Tiques. Traitement préventif et curatif pour l'Egypte.**—*Bull. Union Agriculteurs d'Egypte.* 1916. Nov.-Dec. Vol. 14. No. 117. pp. 85–88. [Reprinted from *Rev. App. Entom.* 1917. Apr. Vol. 5. Ser. B. Pt. 4. pp. 51–52.]

"Cattle in Egypt, if left untended, frequently become entirely covered with ticks. It has been proved that infection in the tick is hereditary and that the piroplasm occurs in the salivary glands of the larvae, which can therefore directly inoculate the host. Piroplasmosis in cattle may be acute or chronic, the acute form being often responsible for a mortality as high as 80 per cent. The only curative treatment which the author has found to give complete satisfaction, other than quinine and trypanblue, is arrhénal; a hypodermic injection of one dose of one gramme is generally sufficient to allay the fever. This treatment to be effectual must be given as soon as the symptoms of the disease appear. Preventive measures should be directed against cattle sheds as well as against the cattle themselves. The earthen flooring should be frequently renewed and all cracks and crevices which could form a shelter for the female tick during oviposition should be filled up. A coat of quicklime should be given occasionally to the wall supporting the manger. Each animal should be thoroughly curry-combed, which is a far more effective method of removing all kinds of parasites than the use of any drug. By these simple means, the Administration have succeeded in reducing the cases of disease among their cattle to a minimum."

Fletcher (T. Bainbrigge). **Report of the Imperial Pathological Entomologist.**—*Rept. Agric. Res. Inst. & Coll. Pusa, 1915–1916.* Calcutta. 1916. pp. 78–84. [Reprinted from *Rev. App. Entom.* 1917. Mar. Vol. 5. Ser. B. Pt. 3. pp. 38–39.]

"Observations have been continued on the life-histories of various Tabanidae occurring at Pusa. Notes are given on the life-histories of *Tabanus nemocallosus*, the larvae of which are not, apparently, cannibals; *T. albimedius*, which is parasitised by a small Chalcidid, and has three broods annually; *T. striatus*, which also has three broods; *T. sanguineus*; *T. hilaris*; *Chrysops stimulans*, of which the larvae feed on dead earthworms and are probably also cannibals; the larvae of *Gastroxides ater* were found in hollows in tree-trunks.

"An account is given of transmission experiments with biting flies in the zone where surra is prevalent. *Tabanus albimedius* and *T. striatus* were found capable of transmitting the surra organism, not only by an interrupted feeding, but also by complete feeding. *T. albimedius* was proved to transmit surra 24 hours after feeding on an infected animal, but it failed to transmit disease after a longer interval. *T. striatus*, however, was found capable of transmitting surra (in one experiment with two flies) as long as 72 hours after feeding on an infected host. Smaller species, such as a *Tabanus* near *virgo*, were tried, but were not found to transmit disease. *Ctenocephalus felis* and dog and cattle fleas were also found incapable of transmitting surra. *Philaematomyia insignis* is only capable of transmitting surra in the case of an immediate interrupted feeding, the maximum interval, between leaving an infected host and commencing to feed on a previously uninfected animal, for which positive results were obtained, being only seven minutes, although positive results were obtained by direct inoculation of abdominal contents of infected flies as long as 28 hours after feeding on a surra-infected animal.

"Surra is not transmitted hereditarily to the progeny of infected females of *Tabanus striatus*, *T. albimedius*, or *Philaematomyia insignis*. . . ."

"Many maggots causing myiasis in domestic animals have been received and the flies bred out from them."

"Among the ticks received, *Ornithodoros savignyi* was under observation throughout the year. A species identical with, or near, *O. lahorensis* was received from Agra. Both were fed on goats."

BOUET (G.) & ROUBAUD (E.). **Répartition des Glossines à la Côte d'Ivoire.** [Distribution of Glossina in the Ivory Coast.]—*Bull. Soc. Path. Exot.* 1917. Jan. Vol. 10. No. 1. pp. 37–39.

In a former publication Bouet (1907) gave a few indications on this subject but he now admits that he was mistaken in identifying *G. morsitans* in the Ivory Coast. The true *morsitans* does not appear to exist in this colony and the species was in reality the nearly related *G. longipalpis*. The following is the distribution of the various species in the light of the authors' present knowledge.

From the coast up to latitude 6° N. *G. palpalis* and Glossina of the *fusca* group predominate. Between 5° 30′ and 5° 50′ is the only part of the fly belt where *G. pallicera* can be found and this part also contains almost all the *medicorum* and *nigrofusca* types identifiable in the colony.

Towards 6° 20′ a belt containing *G. longipalpis* commences and this extends and becomes absolutely predominant throughout the hinterland of the Ivory Coast up to the tenth degree, forming in connection with similar belts of the Gold Coast and of Togoland a large invaded tract between the coast and the Sudanese region. Towards the eighth degree *G. tachinoides* appears and predominates across the northern part of the colony.

Working northwards from the coast there are thus four principal Glossina belts, viz., a *palpalis* and *fusca* belt, a *pallicera* belt, a *longipalpis* belt, and a *tachinoides* belt.

JACK (Rupert W.). **Tsetse Fly Investigations, Sebungwe, August-September, 1916.**—*Report to Director of Agriculture, Salisbury, Rhodesia. British South Africa Company.* Dated 23rd September 1916. [MS. Report received in Colonial Office, November 27, 1916.]

The author journeyed in a south-westerly direction from Salisbury towards the Gwai River observing the extension of the area infested with tsetse especially along the water-courses traversed. It was found that the fly had spread rapidly in certain parts of the district, especially at the south-western corner of the big fly belt where the fly has advanced in a southerly direction from the Mzola to the Kana River, and in a westerly direction to the Shangani River, i.e., along the two confluent water-courses running into a stream which runs in a north-westerly direction into the Zambesi. The area around the confluence of these streams is not yet infested. The author believes that tsetse was carried down southwards from the upper stream, which is dried up in the dry season, to the lower one by means of large bands of game moving down to the latter stream in the evening to drink. A further spread southwards towards the Gwai River is anticipated. A large increase in the number of fly is reported at the head waters of the Mzola River, and extensions of the infested areas are noted in the neighbourhood of the Sengwe and Sasame Rivers.

In the course of observations on Meare's Farm (Sikombella River), evidence was obtained in support of YORKE's theory that trypanosomes of the *T. pecorum* type are capable of being transmitted from an infected to a healthy ox by some agency apart from tsetse fly. The oxen which had survived after visiting a known fly belt in October died in December following their return, and in the meantime transmitted the disease to twelve other oxen on the farm. In March five oxen again journeyed over a distance of 80 miles to another fly belt and on their return over 20 cattle contracted the disease on the farm. No tsetse fly could be found on the farm and the fly has not hitherto been discovered within a radius of 30 miles of the farm.

Experiments upon the effect of the exclusion of game upon trypanosomiasis are suggested and for this purpose the necessary arrangements are enumerated that would have to be made at Sipani Vlei, "an area which from its limited extent, intense infestation, and isolated position in the dry season, is admirably suited for an experiment."

ROBERTSON (Muriel). **Report upon the Present Conditions of the Siroko Valley, Mount Elgon.** Dated 21st January 1914.—19 pp. With 1 map. [MS. Colonial Office Report.]

The area investigated as to the distribution of *Glossina palpalis* from 17th November to 31st December, 1913 consisted of a number of valleys and water courses taking their origin from the eastern slopes of a short rugged ridge of mountains, the highest point of which is Mount Elgon, situated on the border between the Uganda Protectorate and British East Africa. The main stream—the Siroko River—takes its origin from the south-eastern slopes of the mountain, then runs in a northerly direction for a distance of over 30 miles, and becomes lost in marshy swamps. This river and two other small rivers which run together eastwards into it a few miles from its source are fringed with irregular, short, narrow strips of forest in which moderate numbers of tsetse were discovered; the fly was not however found at the upper parts of these rivers although the vegetation in many places appeared well adapted to harbour tsetse. No tsetse was found on the banks of the rivers originating to the north of the last-named rivers, nor in the marshes into which they emptied themselves. The main valley is continuous to the west with the great Kumi plain and is isolated from other fly areas. The distribution of the fly in the valley is indicated on the accompanying map.

1,004 flies were fed on two healthy dogs and one healthy goat with negative results. Dissections of the flies subsequently showed the presence of flagellates in the gut of 24; flagellates were also found in the proboscis of one of these but they were not attached and were few in number. These organisms were of the *T. grayi* type and "this type of flagellate forms no part of the life-cycle of any of the pathogenic group of mammalian trypanosomes;" they were most probably derived from the crocodiles which are very numerous in all these valleys. Nine inoculations were made into healthy dogs, of the blood of buck shot in the valley with negative results.

No case of sleeping sickness or of cattle trypanosomiasis has yet been reported in the valley and the author's observations indicate that "the mammalian group of trypanosomes has not yet arrived in the Siroko Valley fly-belts."

The valley is at present administered as a closed area in so far as the cultivation of the land and the building of permanent huts is concerned, but there is no attempt to exclude people entering the valley for hunting, fishing, etc.

The author points out that "an area opened under proper regulation achieves a more satisfactory level of safety than a similar area inefficiently closed." Moreover in this case the extent of the area to be cleared is not excessive nor is the clearing of a very difficult type. Measures are then suggested for repopulating the district. The most economical and efficient method of dealing with the conditions consists in "the temporary imposition of restrictions of intercourse and the gradual but complete clearing of the area by the population settled." There are already in existence schemes for the control of plague and of rinderpest and these might be adapted respectively to prevent the introduction of human and animal trypanosomiases.

The land in this district is for the most part very fertile and is much needed to relieve the congested population of other districts.

In the second part of the report Miss Robertson details points concerning the safe opening and administration of the district.

MYCOTIC DISEASES.

Epizootic lymphangitis.

Velu (H.). **La lymphangite épizootique; symptomatologie, d'après 300 observations personnelles.** [Epizootic Lymphangitis; Symptomatology according to 300 Personal Observations.]—*Bull. Soc. Cent. Med. Vet.* 1917. Mar. 1. *Rec. de Med. Vet.* 1917. Mar. 30. Vol. 92. No. 6. pp. 99–104.

"Epizootic lymphangitis is at present considered to be a disease of the lymphatics and mucous membranes, characterised always and exclusively by the presence of buds and cording of the lymphatics." This, however, does not correspond with the author's experience and he thus classifies the disease into two varieties, viz., (1) an atypical lymphangitis which remains localised in the inoculation wound, and (2) a typical lymphangitis which is manifested by cutaneous lesions (cording and buds) and sometimes by ulcers on the mucous membranes.

Atypical lymphangitis. The most striking characters of the lesions are, resistance to cicatrisation and the formation of fistulae without apparent cause. Very often the original fistula formed becomes constricted and small buds appear around it which later discharge and give rise to new fistulae often communicating with the original one. One finds on examination of these fistulae that they terminate in serious lesions—necrosis of bone, ligaments, or connective tissue—which account for their persistence and the abundant suppuration. The nature of this variety of the disease has hitherto been overlooked by practitioners as, owing to the favourable results following surgical operation, the lesions were supposed to be due to ordinary causes. Microscopic examination, however, invariably reveals the true nature of the disease and enables one to employ a specific treatment.

The various forms of this atypical lymphangitis observed by the author were as follows:—(a) simple shallow ulcers, of frequent occurrence, and (b) simple fistulous wounds, both occurring as complications of ordinary wounds; (c) a testicular lesion, as observed by TEPPAZ in the course of typical lymphangitis, was observed by the author in five cases of this atypical kind; (d) osseous lesions, observed 17 times; (e) conjunctival ulcers, observed in six cases, bi-lateral, and resembling summer sores in appearance; (f) cryptococcic phlebitis (one case); (g) cutaneous form (two cases) resembling contagious pustular dermatitis in appearance; these cases were characterised by the appearance of a small number of buds disseminated over the body and limbs and not united by visible lymphatic vessels.

Typical lymphangitis. In this form the resistance of the tissues apparently becomes broken down and invasion of the lymphatic vessels takes place from the original wound after an interval which may vary from a fortnight to six months according to the author's observations. This form is generally cutaneous, but it often affects the mucous membranes as a complication, following generalisation, or auto-inoculation.

The cutaneous form may be observed anywhere on the body and the course of the disease is always the same. From the original cicatrised or uncicatrised wound very prominent cords are seen along the lymphatic vessels making their way towards the nearest superficial lymphatic gland. Small intradermic swellings of variable size appear along their course giving them a beaded appearance. These swellings become extremely sensitive and the pain often causes great alterations in the temperament of the animal. The swellings after a very variable interval become converted into small abscesses and burst, the smallest discharging a greyish-red liquid which is sticky and can be easily spread out, and the largest abscesses discharging a laudable pus which is of a creamy, thick, mucous appearance, is not sticky and is spread out with difficulty. The very large deep-seated abscesses give rise to a less homogeneous, more serous-looking, pus.

After puncture the pus changes in character and each bud becomes an irregularly shaped protruding ulcer showing no tendency to cicatrisation and oozing a clear liquid from its surface. The inflammation of the lymphatic vessels disappears eventually leaving only the ulcerated buds and sometimes complications in the lymphatic glands, which may attain a considerable size, suppurate and become perforated with fistulae, discharging a pus extremely rich in cryptococci.

Lesions on the mucous membranes.—These most often appear as final complications in cases of generalised lymphangitis and according to the seats affected they assume very varied characters. On the lips and on the external wings of the nostril one finds small papules which may be mistaken for horse pox papules. After a few days these papules become transformed into pustules and ulcerate, small raised umbilicated ulcers remaining which discharge a colourless oily liquid. From the internal canthus of the eye a chain of small ulcers was observed in some cases to run up and down the head giving an appearance very similar to that of summer sores. On the conjunctiva, pituitary mucous membrane, and borders of the lips are sometimes seen ulcers which may, at first sight, be mistaken for those of acute glanders. The ulcer, however, is different in that its base protrudes and forms a prominence from 1 to 2 mm. in thickness on the mucous membrane. The ulcer is surrounded by a lightly coloured zone and it shows no tendency to cicatrisation. The ulcers sometimes become confluent and then give rise to a dull-white granulating mass. This condition leads to a painful swelling, and sometimes suppuration, of the submaxillary gland.

BOQUET (A.) & NÈGRE (L.). **Sur la culture du parasite de la lymphangite épizootique.** [Cultivation of the Causal Organism of Epizootic Lymphangitis.]—*Bull. Soc. Path. Exot.* 1917. Apr. Vol. 10. No. 4. pp. 274–276.

In preceding communications the authors claimed to have observed the development of the above organism in mycelial form in the water of condensation of various media. The medium which they now state to be the most favourable for growth consists of a filtered decoction of dried horse dung in water (400 grammes per 2 litres) containing 1 per cent. peptone, 1·8 per cent. agar, and 4 per cent. glucose. When pus taken from an unopened abscess is sown on this medium and incubated at 24° to 26° C. the cryptococci are found after 18 to 24 hours to increase in size and become rounded and granular. After 48 hours the rounded forms are filled with oily drops and throw out filaments which become segmented and attain a length of from 75 to 100μ. Although there was no visible growth the organism grew more rapidly and much more abundantly than on the other media formerly tried. Sub-cultures were, however, not obtainable on this medium and the growth of the mycelium in the original tube stopped after from 15 to 20 days.

It appeared that these failures might be due to the absence of pus in the sub-cultures and in order to make the conditions analogous to those on the original medium the authors smeared the surface of the horse-dung agar with a sterilised maceration of the lymphatic glands of a horse. Six weeks after inoculation a few very small colonies were observed, which increased slowly in size during the following fortnight both in the case of a primary culture and a first sub-culture. The colonies were spherical, projecting, wrinkled, and greyish, and became more and more adherent to the surface of the medium; the largest was about the size of a pin's head. The colonies were found to be composed of a tangled mass of mycelial filaments, granular in appearance, and often deformed by chlamydospores. At the extremities and on the walls of these filaments large rounded or oval cells were formed by a process of budding. The bud gradually became more and more constricted at its base and was then attached by a short narrow stalk to the mother cell before it finally became detached. These free double-walled cells then contained three or four elements identical with the cryptococci found in pus. These elements were so rare that the authors could not identify them by the usual staining methods, but morphologically they presented all the characters of the asci of ascospores.

The authors conclude that if these results are verified the causal organism of epizootic lymphangitis belongs to the genus Endomyces.

BACTERIAL DISEASE.

MASON (F. E.). **Tuberculosis in Camels.**—*Jl. Comp. Path. & Therap.* 1917. Mar. Vol. 30. Pt. 1. pp. 80–84.

"Tuberculosis appears to be very rare in camels living under normal or natural conditions in all countries except Egypt." Isolated cases have been recorded by LINGARD (1905) and LEESE (1908) in India, by ARCHIBALD (1910) in the Soudan, and also in Algeria.

In Egypt, however, since the first case was reported by LITTLEWOOD (1888), numerous cases have been recorded and the proportion of camels found affected at the Cairo abattoir, where during recent years up to about 2,000 camels are on an average slaughtered yearly for human food, varied from 1·63 to 5·4 per cent. in various years. The higher percentages have been noted since the war, when Egyptian camels only were slaughtered and no Syrian and Arabian camels, which previously were never found affected, were brought in.

The characters of the bacillus on culture and inoculation into small animals indicated that it is invariably of the bovine type. The source of the disease in camels can be easily traced to the custom of the fellaheen of keeping camels in close association with cattle. "All the evidence collected within the last six years tends to show that tuberculosis is not *par excellence* a disease of camels, but that infection takes place primarily from cattle."

The usual method of infection appears to be undoubtedly by inhalation and the lungs are invariably infected. Under ordinary conditions when diet is liberal and work moderate the disease runs a very chronic but progressive course. Under adverse conditions such as continuous transport work in the desert, rapid emaciation sets in with continuous fever, a profuse glairy discharge from the nostrils, pleurisy or peritonitis, and a firm swelling of the superficial lymphatic glands.

On post-mortem examination one finds that the lungs and bronchial glands are invariably infected; "grapes" are frequently seen on the pleura; the parietal pleura frequently escapes infection; the lesions in the lung may take the form of discrete miliary tubercles or a whole lobe may become consolidated and filled with caseous matter and fibrous tissue. There is a marked tendency towards the formation of fibrous tissue. The disease not infrequently produces pericarditis and peritonitis while lesions are not uncommonly also found in the liver, spleen, kidneys, and on the mucous surface of the trachea. Generalisation takes place in about 7 per cent of cases.

The lesions show the usual histology of tuberculous lesions with the exception that giant cells are rare. Tubercle bacilli are fairly easily discoverable. Calcification in a fine granular form sets in early.

The tuberculin test may be successfully employed. In connection with this test the author gives the following figures concerning the normal temperature of healthy camels at rest :—

> " Extreme variation between early morning and late afternoon, from 35° C. (95° F.) to 38·6° C. (101·6° F.).
>
> " At 6 a.m., 35° C. (95° F.) to 37·5° C. (99·6° F.); usual temperature 36·2° C. (97° F.).
>
> " At 6 p.m., 37·4° C. (99·2° F.) to 38·6° C. (101·6° F.).
>
> " A temperature over 37·5° C. (99·6° F.) at 9 a.m. is abnormal.
>
> " A temperature over 38·7° C. (102° F.) at 6 p.m. is abnormal."

DISEASES DUE TO FILTERABLE VIRUSES.

(a) RABIES.

KONRÁDI (Daniel). **Die Vererbung der Immunitat gegen Lyssa. Dritte Mitteilung.** [Heredity of Rabies Immunity. Third Report.]—*Cent. f. Bakt.* 1. Abt. Orig. 1917. Jan. 30. Vol. 79. No. 2. pp. 80–82.

—. **Die Vererbung der Wut. Vierte Mitteilung.** [Heredity of Rabies. Fourth Report.]—*Ibid.* pp. 82–84.

In a former series of seven investigations Konradi demonstrated that immunity towards rabies was transmissible from the mother to the foetus [see this *Bulletin*, Vol. 2, No. 2, p. 94, and Vol. 4, No. 2, p. 62] and that this hereditary immunity is manifested only by the first generation and lasted ten months or longer.

Experiment 8. A bitch was immunised (3–5–1912) by means of a virus which had been submitted to a series of passages through a frog and through fifteen guinea-pigs successively; 2 grammes of the brain of the last guinea-pig were emulsified and injected under the skin of the bitch. The bitch subsequently showed no symptoms, but a guinea-pig inoculated sub-durally with this emulsion died in 52 days of typical rabies.

One hundred and ninety-five days (14–11–1912) after the inoculation the bitch gave birth to six pups, two of which remained alive.

One of the pups when nearly a year old (8–11–1913), was inoculated into the muscles of the back alongside the spinal cord with a dose of 1 c.c. of " street " virus. The dog remained alive and showed no symptoms of disease for one year. However, control animals, one dog and one guinea-pig, died after 26 days, and a rabbit inoculated sub-durally died after 20 days, of rabies.

The second pup was inoculated in the same way at the age of 2 years (13–11–1914) with the virus of human rabies. Twenty-four days afterwards (7–12–1914) it died of typical rabies. The mother's immunity was of still shorter duration as the bitch died subsequent to a test inoculation performed ten months (11–3–1913) after immunisation.

Experiment 9. A bitch was immunised (13–2–1914) with a virus which had passed successively through a series of eighteen rabbits, then through a fowl, and finally through a guinea-pig. The fowl died in 59 days after sub-dural inoculation and the guinea-pig in 94 days. The bitch was injected subcutaneously with 2 grammes of cord and subsequently showed no symptoms, but two control guinea-pigs injected sub-durally died in 20 and 22 days, respectively, of typical rabies.

In order to confer a still greater immunity the bitch was again inoculated (16–4–1914) with 2 grammes of cord containing virus which had successively passed through a fowl and through four guinea-pigs. This inoculation was also well stood, but a control guinea-pig died in 20 days of rabies.

The bitch had a litter of three pups (30–7–1914) of which two remained alive for observation. At the age of 1 year 8 months and 25 days (632 days) (24–4–1916), the two pups were simultaneously inoculated into the muscles of the back with "street" virus. Six months later they were still alive and well, but control animals inoculated in the same manner, viz., one rabbit and one dog, died after 20 and 39 days, respectively, of typical rabies.

The mother in this experiment also showed a shorter immunity, for it died of rabies after an earlier inoculation (11–12–1914).

The immunity of the two pups thus lasted for at least 632 days, which is much longer than Ehrlich and his successors accepted as a certain proof.

Experiment 10. A bitch was inoculated subcutaneously with an emulsion made from 24 grammes of cord containing virus obtained after 57 successive passages. The virus was kept for five days in carbol-glycerine with a view to attenuation, but when tested on a guinea-pig and a rabbit no weakening was found in reality to have taken place. On the 160th day after inoculation (4–4–1915) the bitch whelped a litter of four pups. These four pups died at the age of 14, 17, 30, and 34 days, respectively, all showing Negri bodies in the central nervous system and, in the case of the last two, typical symptoms of rabies.

Experiment 11. A bitch was injected (12–1–1915) subcutaneously with 4 grammes of guinea-pig cord containing virus which had passed first through a fowl and then through a series of eleven guinea-pigs.

Three days afterwards the mother gave birth to four pups. All four pups died, when 3, 15, 16, and 16 days old, respectively. Negri bodies were discoverable in all except the second pup that died, and in each case a guinea-pig inoculated into the muscles of the neck from the cord of a pup died of typical rabies in from 14 to 19 days.

In this case it was thus shown that the rabies virus appears as early as three days in the blood of the mother.

It is added that the mother had obtained no immunity for after a test inoculation on 7–4–1915 she died within 12 days of typical rabies.

Experiment 12. A bitch was immunised (31–1–1915) by subcutaneous inoculation with 3·5 gramme guinea-pig cord, the "street" virus in this case having been passed first through a fowl and then through a series of twelve guinea-pigs.

Forty-nine days after immunisation the mother aborted a well-developed foetus from which a guinea-pig was inoculated into the muscles of the neck. This guinea-pig died 15 days afterwards of typical rabies. The mother was inoculated twice (5–5–1915, and 15–1–1916) subcutaneously with an emulsion of guinea-pig cord as above for further immunisation and was still alive in October, 1916.

The author concludes that "from investigations made in this direction in the course of the last twelve years it is an established fact that the rabies virus is transmitted from the mother to the foetus."

(b) RINDERPEST.

SHILSTON (A. W.). **Rinderpest. Preparation of Anti-Serum.**—*Agric. Res. Inst. Pusa. Bull. No. 64.* 1916. 18 pp. With 21 tables. 1916. Calcutta. Supt. Govt. Printing. India.

In this paper a series of experiments is summarily described performed with the object of raising the potency and effecting economies in the manufacture of anti-rinderpest serum at the Muktesar laboratory.

A comparative study of the yields resulting from different methods of separating serum from the blood has already been described in this *Bulletin* [see Vol. 4, No. 4, p. 188. NORRIS, R.V.] and the enormous quantities issued have also been referred to [see Vol. 5, No. 1, pp. 66 and 68].

Reference is made to the literature dealing with this subject. It appears that no accurate data have hitherto been published, and in the light of recent experiments in the production of other anti-sera it also appears that the interval between the last injection with virus and the first bleeding has been unnecessarily long. As the result of a series of observations made by HOLMES the most recent method employed at the laboratory consisted in bleeding at 15 and 17 days' intervals after injection, at the rate of 6 and 8 cc. per pound body weight. The method investigated by the author consisted in bleeding each time at the rate of 6 cc. per pound of body weight at 8, 12 and 16 days after the injection of virus.

In the manufacture of anti-serum both hill bulls and plains buffaloes are employed. The latter animals are much less susceptible to rinderpest than hill bulls, but they were introduced by HOLMES for the manufacture of serum as the supply of hill bulls is strictly limited. Hill bulls are, however, necessary for the production of virulent blood for inoculation and for routine serum testing.

In the first experiment 10 hyper-immune serum-making hill bulls were selected and divided into two lots; after inoculation with virulent blood these were bled at the two different series of intervals described above. The yields of serum per pound body weight were noted at each bleeding for each animal. The mixed sera obtained at each bleeding were then tested on susceptible hill bulls which were simultaneously inoculated with 0·5 cc. of virulent blood. In each test six animals were employed and were divided into three lots, the doses injected in the successive lots being 27, 54 and 81 cc. of serum per 600 lb. body weight. In addition two control animals were inoculated with virulent blood only in each test, and bled to death for virulent blood at the height of the attack.

From these tests it was found that:—

"(1) The rinderpest antibodies were present in the serum of hyper-immune animals in full amount eight days after the injection of virulent blood.

"(2) At the second bleeding on the 12th day the antibodies were still present in sufficient quantity for 27 cc. per 600 lb. body weight to protect hill bulls against the injection of virulent blood, which is equal to 1·5 cc. per 600 lb. in the case of plains animals.

"(3) The serum from a third bleeding four days later was still protective in doses of 54 cc. for hill bulls or 3 cc. for plains bulls per 600 lb. body weight.

"(4) The serum from a first bleeding 15 days after the injection of virulent blood was fully protective in doses of 27 cc. for hill bulls or 1·5 cc. for plains bulls, but at a second bleeding on the seventeenth day the potency had fallen so that 54 cc. per 600 lb. body weight were required to give full protection to hill bulls."

In the second experiment the value of the mixed serum obtained from three bleedings on the eighth, twelfth and sixteenth day after injection was compared with that of mixed serum from two bleedings taken on the fifteenth and seventeenth days. The procedure was the same as before. It was found that both lots of serum were protective in doses of 27 cc. for hill bulls or 1·5 cc. for plains animals per 600 lb. body weight, but that the "three bleedings" serum gave a distinctly better test.

In the third experiment the animals bled at the two series of intervals described above were inoculated with rinderpest virus at an interval of 12 days from the last bleeding; the two lots of animals were then bled as before and the mixed serum from each lot was compared. It was found that neither of the mixed sera in this experiment gave as good results as the sera of the second experiment. "The difference was, however, not sufficiently marked to draw any definite conclusions as to the greater production of anti-bodies having occurred in the animals previously bled three times than in those only bled twice."

In the fourth experiment it was decided to compare the "three bleedings" and "two bleedings" systems on a large scale, testing the two methods on hill bulls and buffaloes separately. 64 hill bulls and 18 buffaloes were thus employed in the first system and 103 hill bulls and 58 buffaloes in the second system. The yields of serum per pound body weight were noted as before and the mixed sera from each bleeding of hill bulls and of buffaloes were tested on susceptible hill bulls. The conclusions were as follows:—

"(1) The mixed sera obtained by both the 3-bleedings and 2-bleedings methods from hill bulls and buffaloes were protective in doses of 27 cc. for hill bulls or 1·5 cc. for plains animals per 600 lb. body weight; this is less than one-third of the standard dose issued.

"(2) The mixed sera obtained from hill bulls by the two methods were of about equal value according to the tests.

"(3) The mixed serum obtained from buffaloes by the 3-bleedings method was markedly stronger than that obtained by the 2-bleedings method and would probably protect in even smaller doses than 1·5 cc. per 600 lb. body weight in plains animals."

The author next gives a summary of the records of the body weights of the animals, the amounts of blood taken and yields of serum at each bleeding in experiments 2 and 3. A comparison of the figures for the "three bleedings" and "two bleedings" method in this observation showed:—

> "(1) An increased yield of serum after each injection of 2·81 cc. per lb. body weight by the former method (9·6 cc.) as against the latter (6·79 cc.); this means a total increased yield of 41·4 per cent.
>
> "(2) An increased percentage yield of serum from the blood taken of 5·3 per cent. by three bleedings (54·5 per cent.) over that from two bleedings (49·2 per cent.), the proportion of serum increasing with each successive bleeding of a series."

These results were confirmed by the yields of serum obtained in the experiment conducted on a large scale (Experiment 4).

[It appears that the author draws rather far-reaching conclusions from the results of titration experiments in which a comparatively small number of animals were used. The very small dose (1½ cc. per 600 lb. body weight) of serum calculated to be sufficient for immunising plains animals rather inclines one to think that a large proportion of these animals must possess a high degree of natural immunity towards rinderpest and that thus the small proportion of losses in an outbreak dealt with would not be altogether attributable to the use of the serum; this statement does not, however, minimise the value of the experiments performed with the object the author had in view.—Ed.]

von Ostertag (R.). **Ueber Rinderpest. Ein Beitrag zum Stande und zur Bekämpfung der Tierseuchen in Deutsch-Ostafrika.** [Rinderpest. A Contribution on the Incidence and Eradication of Animal Diseases in German East Africa.]—*Zeitschr. f. Infektionsk. parasit. Krankh. u. Hyg. der Haustiere.* 1916. Sept. Vol. 18. No. 1. pp. 1–48. (Continued from Vol. 17).*

(4) *Symptoms and post-mortem appearances.*—Under this heading, which covers half the present paper, Ostertag details at great length the appearances presented in rinderpest-affected animals in outbreaks in various districts. These were furnished in official reports in 1912 and 1913 by the Government Veterinary Surgeons (Manleitner, Lichtenheld, Münchgesang and Wölfel), and they are also largely the result of the author's own observations. Although they contain nothing really new, the conclusions arrived at from this careful study are reproduced as follows:—

> "The results obtained by me show how varied might be the clinical picture in different animals of the rinderpest raging at that time in German East Africa, and confirm the truth expressed by one of the first workers on rinderpest, Lorinser, that 'the totality of the symptoms appertaining to rinderpest can never be established in a single affected animal and scarcely in an affected herd, but is always more complete the greater the number of sick animals examined'; Gerlach further adds that neither in one affected animal nor in one affected herd, but only in several herds of different breeds in different outbreaks, countries, and seasons, can the totality of the symptoms and the variations in the progress of the disease be investigated. However, as symptoms of the disease in living animals which must always create a suspicion of rinderpest in one animal my observations point out the following:—
>
> "The simultaneous existence of lachrymation and diarrhoea with a high degree of fever at the commencement and a normal or subnormal temperature towards the end of the disease. The suspicion is

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* The publication containing the first part of this article has not yet been received, but an extract of it will appear when it is obtainable.

strengthened by the appearance of diphtheritic patches and ulcers on the mucous membrane of the mouth and of reddish streaks on the mucous membrane of the posterior extremity of the alimentary tract. In dead or slaughtered animals the suspicion of rinderpest is aroused by the presence of croupous deposits on, or a diphtheritic inflammation of, the mucous membrane of the mouth and of the fourth stomach, of the solitary follicles or Peyer's patches, or other parts of the intestinal mucous membrane; reddish streaks on the rectum or colon, enlargement of the gall bladder, and a thickened condition of the gall, and all these changes without any specific lesions of the spleen and of the kidneys.

"The changes of the gall bladder and gall appear both in rinderpest in German East Africa as well as in European rinderpest—which was designated centuries ago as 'Great Gall' (Grossgalle) owing to the most striking lesion in the gall bladder—to be the most constant sign of the disease. All other changes may vary but one can nevertheless by sufficient observation of the mucous membranes of the digestive tract in one or other locality (mouth, fourth stomach, small or large intestine) discover one or more of the specific lesions of rinderpest; here one must have in mind that in East Coast fever similar ulcers may be found on the mucous membrane of the fourth stomach as in the case of rinderpest.

"The results of post-mortem examination will thus, taken in conjunction with the symptoms observed during life (lachrymation, diarrhoea, and at the beginning a high morning temperature), regularly enable one to make a certain diagnosis even in a single case, the correctness of which can be confirmed without any doubt by the further course of the disease in an outbreak. A negative blood examination gives further support in a single case, but a positive result (showing piroplasms, trypanosomes) on the other hand gives no ground to exclude the possibility of the disease, for the piroplasm and trypanosome infection may be an accidental complication. This latter statement must be laid stress on for on the strength of a positive result obtained by the examination of one blood film forwarded for examination wrong action might be taken if one overlooked the possibility of the existence of rinderpest and if one neglected the further examination of the affected herd."

(5) *Transmission of rinderpest to other domesticated animals, especially sheep and goats.*—In the European outbreaks which occurred over 60 years ago great losses were observable amongst sheep and goats which had been in contact with rinderpest-affected cattle. Great losses also occurred among them in Egypt at that period. GERLACH, however (1865), denied that serious losses could be caused in sheep and goats although a fever and slight symptoms could be set up by means of artificial inoculation. In German East Africa no disease appeared in sheep and goats in the course of the epizootic studied by the author and according to the natives none died in the outbreak of rinderpest which occurred in 1892, and this circumstance saved the Masai from starvation after their cattle had been destroyed.

Reference is also made to the experiments of KOCH on the inoculability of the virus to sheep and goats and to his suggested use of the sheep as a medium for transporting rinderpest virus. Ostertag, however, states that the facts established by KOCH in 1896 with regard to South African sheep and goats did not apply to German East African sheep, as the rinderpest with which KOCH experimented was of a different character from that of German East Africa. Experiments carried out by Ostertag's assistants gave negative results as far as visible symptoms were concerned.

The solution of the question as to whether East African sheep or goats could be used for eliminating piroplasms infective for bovines from the rinderpest virus would be of great practical importance and moreover blood obtained from rinderpest-affected cattle loses its virulence in a comparatively short time (50 hours) and thus cannot be carried *in vitro* over long distances. Sheep and goats are in addition more easily transported and run less risk of spreading the infection during transit.

Tests made in Mpapua showed that the rinderpest virus could be carried in sheep and goats without weakening the virus and this made it possible to obtain a reliable virus for inoculation when severely affected cattle from which virus could be obtained were not available.

(6) *Eradication of rinderpest.*—Immediately on the receipt of reports from MANLEITNER and WÖLFEL that rinderpest had broken out the Government of German East Africa took steps to suppress the disease. The infected districts were isolated and the export of samli (animal fat) and hides was only allowed on condition that the samli was heated to at least 60° C. and the skins were thoroughly dried in the sun. Twelve thousand doses of serum from Cairo were at hand and a further 15,000 doses were obtained from Kabete, British East Africa. All proved effective. Two Institutes for the manufacture of anti-rinderpest serum were set up, one at Engare-Nanyuki and another at Mpapua.

The establishment at Engare-Nanyuki erected by WÖLFEL is described at some length. This station was placed in a forest and native reserve on the east side of the Meru Mountains about 5,000 ft. high, and about 2,500 acres in extent. It was bounded on the east by the deep Engare-Nanyuki River and on the other sides it was surrounded by forest and mountains in which leopards and hyaenas abounded. The spread of infection by the breaking out of infected animals was thus prevented on all sides. In the neighbourhood of the station the game was killed off and the station itself was divided by ditches into different parts, the northern ones being used as pasture and quarantine land. Cattle on arrival were passed successively through two kraals. In the first the blood was examined microscopically and the unaffected animals were then driven to the second kraal and washed with Cooper's dip. They were then put into the quarantine enclosure. A description is then given of the laboratory installations and animal sheds, etc. Seventy-two serum cattle were kept at the place during Ostertag's stay.

The method of immunisation was as follows:—Two strains of rinderpest virus were employed. An initial immunity was produced by means of the ordinary double inoculation, the dose of serum being small so as to obtain a powerful reaction. After four weeks' rest the animals each received 1,000 cc. of virulent blood and after a further two weeks 3,000 cc., injected subcutaneously over the whole body in quantities of 100 cc. After the disappearance of the reaction—about 14 days after the second hyper-immunisation—the first blood extraction period commenced and this consisted of six extractions, each of 3½ to 4½ litres according to the size of the animal, taken at intervals of four days. The animals were then given three weeks' rest and again inoculated with 3,000 cc. of virulent blood to be ready again in another three weeks time for a further blood extraction. This was repeated until the animals were no longer fit for serum production.

The virus was obtained from young heifers and calves which had been inoculated with from 5 to 10 cc. of virulent blood. The animals showed a rise of temperature in within three to five days after the infection and after seven to eight days the first symptoms of disease appeared. By means of blood and gland examination repeated daily during this period other diseases were eliminated and especially those due to *P. bigeminum*, *P. mutans*, and *Anaplasma marginale*. Three days after the commencing rise of temperature 3 to 5 litres (calves 1 litre) of blood were extracted and on the fourth day a similar quantity. If the animal was very much exhausted it was bled to death from the carotid. Animals which bore repeated blood extraction were only completely bled on the tenth day.

A month's collection of serum was titrated at the same time by injecting a series of cattle with 10, 20, 30, and 40 cc., respectively, of serum together with virus and the control animal with virus only. The serum was mixed with ½ per cent. carbolic acid and distributed in 250 cc. bottles. At this place 67,000 doses of serum were manufactured between January and August, 1913. The average dose consisted of 25 cc. of serum for a medium sized animal when used for the double inoculation.

As there are still districts, viz., the Urundi and Ruanda districts, which are free of rinderpest an endeavour was made to keep a large reserve of serum to cope with the possibility of outbreaks of rinderpest occurring in these districts.

The establishment of a second serum station was attended with some difficulties owing to the lack of suitable sites, but it was finally established in Mpapua and it commenced delivering serum in July, 1913. Wölfel was again sent to this station to superintend the manufacture of serum and also with the assistance of a trained staff to investigate some important problems, which are then detailed by the author, in connection with rinderpest.

Before the manufacture of serum had attained sufficient dimensions the ordinary prophylactic measures were adopted, consisting in prohibition of movement, destruction of dead bodies, and isolation of affected animals. Dung was removed from the isolation kraals but this was not possible everywhere as some of the natives (the Tagago) use these for burying their dead. Great difficulties were encountered in carrying out the policy of isolation. The flesh of the diseased cattle was allowed to be eaten provided it was well cooked, but the transport of raw flesh was forbidden on account of the danger of spreading the infection.

Koch's gall immunisation was also attempted on a fairly large scale. Though not very satisfactory it was found to be capable of giving fairly good results provided the gall was taken when fresh and from an animal which died seven or eight days after the commencement of the illness or was killed just before death. The immunity was prolonged if inoculation with virulent blood was performed 10 days after the gall inoculation. The production of abscesses at the point of inoculation gained disfavour for this method in the eyes of the natives. 10 cc. of gall was found necessary for immunising one bovine and as the gall bladder contains 500 cc. of gall a sick animal can furnish material sufficient to immunise 50 sick animals. The losses in the Bahi district amounted to 10 per cent and in Bugiri to 25 per cent. with this method.

The only means for the suppression and eradication of rinderpest in a country like German East Africa according to Ostertag is the simultaneous method, that is to say, inoculation with specific serum and virulent blood.

The objections raised against this method especially by the Bloemfontein Rinderpest Conference are referred to and on the other hand the short period of immunity conferred by serum alone, as shown by WARD's experiments in the Philippines, etc., is pointed out.

The experiments carried out at the Veterinary College in German East Africa demonstrated the superiority of this method. In East Africa the introduction of piroplasmosis with the virus was found to be unimportant; as nearly all the cattle are infected with these organisms they have all become immune. Also, rinderpest usually occurs in districts where the tsetse fly is unknown or seldom found and, moreover, the natives are very careful in guarding their cattle against the tsetse fly. The results of the simultaneous inoculation in German East Africa fulfilled all expectations. Failure only took place in two instances, viz., when an imported untitrated serum was issued and secondly when an infected serum was used. The losses as a rule amounted to only 1 per cent.

Instances are then given of outbreaks in which the beneficial results were easily observable. In the case of some animals transported to the coast for slaughter inoculation with serum alone was performed. As this transport in some cases took about six weeks or more Ostertag considers that the protection afforded was very doubtful.

Ostertag's conclusions are as follows:—

"(1) In all affected centres all animals from a milch calf up to an adult ox must be thoroughly inoculated in order to ensure safety. If this is not done dangerous rinderpest centres are created with regular sickening of the growing young cattle. The healthy animals must be treated by the simultaneous method and the affected ones with serum alone in double doses. If sufficient serum is not available gall inoculation can be resorted to with the above-described precautions. When inoculation is carried out in this way the insufficiently immunised animals die while the remainder are proof against rinderpest. Six weeks after the stamping out of the disease and after all dung has been burned the animals can be safely transported.

"(2) In addition to the diseased herds those in the neighbourhood should be inoculated and treated in the same way as animals in the affected districts. Calves may be inoculated with pure virus. As soon as sufficient serum is available the susceptible herds must be inoculated with serum only to prevent the spread of the disease.

"(3) For the safety of cattle in the settlers districts on the Meru and Kilimandjaro the entire herds should be innoculated.

In order to safeguard the supply of meat to the coast the same should be done to all cattle in the market districts.

"(4) If adequate serum is available all cattle on farms lying apart should be gradually inoculated to prevent a fresh outbreak. I also proposed that all skins should be sent to the nearest Government Station and there inspected by an official as to their complete dryness.

"If this is done the complete stamping out of the disease in German East Africa may be looked forward to."

Ostertag further recommended the inoculation of all cattle on the

importing the disease from

the large native reserves in British East Africa. The danger from British East Africa should be guarded against on account of the permanence of rinderpest in Abyssinia and Somaliland.

ZONCHELLO (A.). **Il gulhai nel Sahel.** [Rinderpest in Sahel.]—*Clinica Vet.* 1917. Mar. 15. Vol. 30. No. 5. pp. 113–132.

The Sahel district is a long strip of country bordering the Red Sea in the Italian colony of Eritrea. Although rinderpest was very prevalent in other parts of the colony the Sahel district appears to have been free of disease until the year 1914, when after the return of a herd, which had been taken out of the district into the neighbourhood of an affected centre, in the rainy season rinderpest appeared and immediately caused a serious outbreak throughout Sahel. The mortality rose up to over 95 per cent. of the total head of cattle and caused great misery among the entirely pastoral population. Recourse was then made to a large extent to raising sheep and goats or to mixed flocks. In the following year rinderpest broke out afresh, and the disease has since become enzootic. The mortality, however, progressively decreased until it did not, except in rare instances, exceed 50 per cent. In rare cases the mortality was nil.

Rinderpest appears to have been first imported into Eritrea in 1887, and caused great havoc at the time. Its spread was occasioned, according to the author, through the incompetence and dilatoriness of the authorities in the administration of elementary prophylactic measures; instead, specific measures of treatment were attempted on a large scale, with, upon the whole, rather unsatisfactory results. In 1903 it was thus decided to adopt the simultaneous method, or KOLLE & TURNER's method, just at the time when THEILER and the Bloemfontein Conference condemned it.

From inquiry among the natives the author then details the history of attempts at sero-vaccination in eight different outbreaks in Sahel from 1905 up to the time of his arrival (1914). In many instances, however, it appeared that although the results were quite satisfactory in the case of the animals treated the method created new centres of disease and a considerable spread from the original centre. The failure to get better results, however, judging from the figures presented by the author, appears to the reader to be due not to defects in the method, but to its not being rigorously or rationally carried out.

The British authorities in the Soudan protested against its use on the Anglo-Italian frontier in the winter 1914–1915 as the Italians were accused of maintaining the virus and distributing it.

The method adopted by the author on his arrival, after a study of the disease, was to proceed simply by strict isolation of existing centres. The results obtained in less than a year were considered to be most satisfactory and it is believed that if this plan was adopted throughout the colony and a close watch kept on the Abyssinian frontier rinderpest would soon be caused to disappear almost entirely. This method seems also to be more in favour among the natives, who soon learn to recognise its advantages.

It is believed that wild animals are susceptible to rinderpest and sero-vaccination should be particularly forbidden where these exist. The affected wild animals are said to isolate themselves from other animals. According to wide enquiry among the natives goats do not naturally contract rinderpest in this district, and, moreover, they believe that cattle, such as transport cattle living among herds of goats, do not contract the disease in the scene of an outbreak. The author quotes an observation of his own which corroborates the view of the natives.

Unnecessary delay is caused in treating a herd by inoculation. It is held by many people in the district that the Serum Institute at Asmara prevents the disease from being finally extinguished in the colony. The cost of sero-vaccination, moreover, amounts to about 25 per cent. of the value of the inoculated animals.

(c) NAIROBI SHEEP DISEASE.

MONTGOMERY (Eustace). **On a Tick-borne Gastro-Enteritis of Sheep and Goats occurring in British East Africa.**—*Jl. Comp. Path. and Therap.* 1917. Mar. Vol. 30. Pt. 1. pp. 28–57. With 6 charts.

A brief reference to this condition was made in the Annual Report of the Veterinary Bacteriologist for East Africa for the year 1914-1915 [see this *Bulletin*, Vol. 5, No. 1, p. 66]; the experiments upon which the conclusions were based are detailed in this paper.

Field observations. The disease was first brought under the author's notice in 1910 when heavy mortality was observed among the large numbers of sheep brought by traders from various outlying areas into the Nairobi district. The epizootiology of the disease up to 1915 is then briefly discussed. It is considered that the disease affects essentially the Kikuyu country, which extends from Mount Kenia to Nairobi. No immunity was ever discoverable in sheep in the outlying districts, such as the Masai Reserve, from which sheep were usually imported, and these districts are probably free from infection; the brown tick, *Rhipicephalus appendiculatus*, is remarkably rare in these districts and this probably accounts for their freedom from this disease and East Coast fever.

The mortality among native sheep in naturally occurring outbreaks appears to be very high; in the first observed outbreak 2,000 sheep died out of 3,000 within one month of arrival in the infected area.

The symptoms are briefly those of dulness to commence with, followed shortly afterwards by severe diarrhoea and abdominal pain. Death usually occurs within two days after the onset of symptoms. The temperature is normal while visible symptoms are exhibited, but a characteristic curve is manifested for a day or two before these are observed.

On post-mortem examination one notices evidence of diarrhoea, often a blood-stained discharge from the nostrils, and on examination of the internal organs one finds an acute, often haemorrhagic, inflammation of the mucous membrane of the fourth stomach and of the intestines, splenic enlargement, distension of the gall bladder, and congestion of the trachea.

Laboratory observations. When susceptible sheep have been inoculated with virulent blood a sudden rise of temperature up to 105° or 106° F. is usually observed within 48 hours. This remains high—between 105° and 108° F.—and then falls suddenly to normal, where it remains for one or two days before death or recovery takes place.

There appears to be some difference in the virulence of various strains, the minimum period between inoculation and the initial rise of temperature varying from 36 to 84 hours. Prior to death the temperature may be subnormal. Death usually occurs between four and eight days after inoculation—average 148 hours.

Following infection with ticks the incubation period averaged 9·4 days—minimum 5 and maximum 16—and the reaction 3·6 days.

No visible symptoms could be noted until about the last day of the reaction when symptoms set in as in the natural cases commencing with dulness, loss of appetite, diarhoea, mucous discharge from the nostrils, etc. In the rare cases of recovery the symptoms were usually limited to those of dulness, inertia, and slight anaemia. The onset of diarrhoea appears invariably to indicate a fatal termination. Out of a total of 224 sheep inoculated 3 only failed to react and 130 died. The mortality was much heavier among native sheep (71·5 per cent.) than in half-bred (31·5 per cent.), or in Merino sheep (30·7 per cent).

The post-mortem appearances of animals dead from natural infection from experimental infection with ticks or by inoculation are very constant; these are described in detail by the author.

Sheep and goats appear to be the only animals susceptible. Out of 20 goats, mostly half-bred Angora, one only proved to be immune on inoculation; three gave no temperature reaction but the virus was shown to exist in two of these by sub-inoculation; five gave a very slight temperature reaction but showed no symptoms. The blood, however, was shown to be virulent on inoculation. The remaining 11 goats reacted as in the case of the sheep, but the onset of the disease was delayed by about a day and the symptoms were much milder. A transitory diarrhoea was noted in five only. Two goats died of gastro-enteritis, one on the 6th day and one on the 11th day.

Attempts were made to infect cattle, buffalo, horses, mules, donkeys, and other animals, but negative results only were obtained and their blood was found to be avirulent on sub-inoculation, with one exception in which the blood of an ox was found to be infective 24 hours after intravenous inoculation of a large dose of virus.

Experiments to determine the virulence of the various body fluids and tissues showed that the blood was always virulent when taken during the thermal reaction. It was found that the virus was not destroyed by short contact with equal parts of oxalate-carbol-glycerine solution (oxalate of potash 5 grammes, carbolic acid 5 grammes, glycerine 1,000 c.c. and water 1,000 c.c.). The virus was found to be present in the blood for about one day subsequent to the return to normal temperature. Serum obtained from blood during the infective period was proved to be virulent both on direct inoculation and after filtration. Saline extracts of organs removed from animals dying with the acute reaction were virulent. When the temperature had been normal for some days and the clinical symptoms were present, negative results were frequently obtained. The pericardial fluid obtained from a sheep dead from the acute form of the disease was infective.

The bile gave negative results.

Urine obtained from the bladder of a sheep after death was found to be infective when given in a dose of 10 c.c. subcutaneously. Urine obtained during life at the height of a reaction gave positive results in two cases on inoculation while six experiments were negative, but in two of the latter cases the urine was administered *per os*.

Out of five sheep drenched with faeces obtained after death from animals dead of the disease three did not react while the remaining two died on the 7th and 18th days, respectively, without manifesting any temperature reaction and subinoculations made from one were negative. A watery decoction of faeces passed through a Berkefeld filter failed to infect on subcutaneous inoculation.

A study of the various methods of experimental infection showed that the disease could be regularly and constantly transmitted by subcutaneous inoculation as well as by intravenous and intraperitoneal inoculation. The disease was also readily transmitted by intracutaneous inoculation performed by applying a drop of citrated virulent blood to the shaved and lightly scarified ears of two sheep. The minimum lethal dose of serum was shown to be as low as 0·001 c.c. in one test.

When administered *per os* virulent blood was found to be infective in three cases in doses of 50 c.c. Ten c.c., however, failed to produce a reaction. Two sheep fed with dry lucerne over which 100 c.c. had been sprinkled reacted and died. Another sheep fed with grass over which 50 c.c. of urine obtained after death had been sprinkled remained unaffected. The same sheep when fed with grass over which 50 c.c. of virulent blood had been sprinkled also remained healthy, but when later fed with grass on which 50 c.c. of virulent blood had been sprinkled a reaction occurred and death took place on the 9th day.

Experiments showed that it was not possible to transmit the disease by intimate contact in pens or in a small paddock. It was proved that the natural method of transmission was through the agency of ticks—*Rhipicephalus appendiculatus*—which had fed as nymphae on reacting sheep.

Bacteriology. Direct microscopic examination was negative and no organism was cultivable on ordinary media.

The filterability of the virus was demonstrated in numerous experiments, in which blood, in dilutions of from 1 to 4 up to 1 to 999 with saline solution or with tap water, was passed through a Berkefeld No. 7 and Chamberland F candles. The number of negative results formed a small minority and these were probably due to the use of occluded candles.

Experiments to ascertain the resistance of the virus showed that a recovered animal is not a reservoir for the virus. Blood taken from recovered animals whose temperature had been normal for from 7 to 10 days failed to infect even in large doses. The resistance of the virus *in vitro* was found to be comparatively long. Sterile serum or citrated blood was found to retain its virulence for about 28 days when exposed to the air as in plugged flasks, for up to 45 days when contained in sealed tubes or ampoules, and for about a week when mixed with equal parts of oxalate-carbol-glycerine solution.

Citrated blood kept at 37° C. in the incubator for 42 hours retained its virulence. When dried *in vacuo* at 37° C. for 72 hours the virulence had disappeared.

A temperature of 50° C. acting for one hour did not destroy the virus; exposure for two hours at this temperature produced partial destruction, the inoculated sheep developing only a temperature reaction and becoming immune to subsequent inoculation. Inoculation of a fairly large number of sheep with blood thus exposed for 1½ hours produced variable results ; about a half developed a delayed reaction and died while nearly all the rest showed slight reactions and became immune

A temperature of 60° C. acting for from 5 minutes to 1½ hours completely destroyed the virulence.

Mode of transmission. A number of experiments are detailed in which susceptible sheep were grazed over pastures believed to be contaminated by the infection, " and on every occasion one or more contracted the disease even if they were so muzzled as to prevent the animal from eating the grass or drinking the water of that infected area."

Sheep fed on grass cut from an infected area did not contract the disease, but it is remarked that the grass obtainable in these cases was procured from the longer growths occurring close to the village huts and neglected by sheep, and not the short turfy couch grass grazed over and harbouring ticks.

The rôle of ticks in the transmission of the disease was ascertained in the first place in a number of experiments with ticks obtained from naturally reacting sheep. A number of adult *Rhipicephalus appendiculatus* and a few adult *Amblyomma variegatum* emerged from the nymphae. Those obtained from all the other stages of ticks collected died prematurely. When applied to susceptible sheep *R. appendiculatus* was found invariably to transmit the infection while the other species of tick gave negative results.

Numerous experiments were also performed with laboratory-bred ticks. It was found impossible to convey the disease by means of larval *R. appendiculatus* born of mothers which had fed on reacting sheep. Likewise nymphae which were born of mothers feeding on sick animals and which did not convey the disease in the larval stage failed to convey the infection. Ticks which had fed as larvae on reacting sheep and failed to transmit the infection as nymphae also failed to convey the disease in the adult stage.

Experiments, however, showed that ticks which had fed as nymphae on reacting sheep in most cases transmit the disease as adults. The blood of animals thus infected was found to be virulent on sub-inoculation.

Immunity. An animal which has recovered from the natural or the experimental disease does not react to a second infection and tests indicated that the duration of this immunity may extend for several years. Half-bred and pure-bred sheep appear to be much more resistent to infection than native sheep. Owing to the peculiar conditions of grazing adopted by the natives the disease appears to be very localised even in infected areas.

Artificial immunisation yielded by no means promising results. Attempts were made to prepare an anti-serum by inoculating immune sheep subcutaneously, intra-peritoneally and intramuscularly with citrated virulent blood in doses up to 500 c.c. This dose could be given as a second injection. After a number of injections the animals were bled in about a fortnight after the last injection and a further maximum injection was made if necessary.

"The sera obtained from each animal, or from a series of animals, after each hyperimmunising were kept separate and used in independent tests, either alone or in association with virus given simultaneously or at variable intervals later.

"No clearly satisfactory results were obtained. It appeared that when sheep were strongly hyperimmunised the sera acquired haemolytic properties and killed a higher proportion of animals than it saved; and if fortification was not intense it possessed little or no prophylactic powers.

"As the object of this work was to devise measures which would safeguard the sheep-owner should the disease gain entrance to his flocks, it became apparent that serum prophylaxis, entailing the manufacture of expensive serum, would not be a practicable method except in extreme cases. Further, additional research indicated that the disease did not exist in the districts wherein sheep farming was extensively carried on, and as this line of preventive treatment could not yet be applied to the native Reserves the enquiry was suspended."

A study of the phenomena of haemolysis in sheep inoculated with the serum, together with details of results obtained, next follow.

A small number of experiments indicated that a quite appreciable attenuation of the virus is effected by passage through goats, and that the results appear to justify observation on a more extended scale.

Prevention. Movement of affected flocks should be prohibited, but this is difficult to effect in practice.

"Individual owners of land where *Rhipicephalus appendiculatus* exists should not permit the entry of doubtful sheep until they have undergone a quarantine of at least 21 days without any deaths occurring from this disease. The sheep might then be introduced. Should deaths occur, the quarantine area grazed over must be regarded as infected; and, though the sheep can then be moved without fear, it should be destocked of sheep and goats for eighteen months, and grazed with cattle only for that period."

A small experiment indicated that the dipping of sheep at three-day intervals might be considered beneficial.

"The eradication of ticks capable of carrying the disease should form the basis of preventive measures.

"*Rhipicephalus appendiculatus* is also the carrier of East Coast fever in cattle, and for its eradication cattle must be dipped every three days.

"There is no doubt that dipping cattle at a three-day interval will very greatly clear the ground of all ticks, and in their absence gastro-enteritis of sheep cannot spread."

(d) VARIOLA.

GAUDUCHEAU (A.). **Recherches sur la variole-vaccine.** [Investigations on Variola-Vaccinia.]—*Bull. Soc. Path. Exot.* 1917. Mar. Vol. 10. No. 3. pp. 260–268.

In this memoir the author presents the results of experiments made during the course of the last ten years at the Vaccine Institute, Tonkin (French Indo-China), on the relationships between variola and vaccinia.

The following are his conclusions:—

"(1). There exists no symptom by which one can absolutely and constantly differentiate between variola and vaccinia.

"(2). Variola immunises against vaccinia and vice versa.

"(3). A few attempts at the transformation of variola into vaccinia have given positive results.

"(4). The differences which exist between the two states of the virus appear to be solely in the degree of adaptation to the susceptible species and constitute two varieties or types of the same virus: the human type or variola and the bovine type or vaccinia."

MISCELLANEOUS.

VAN SACEGHEM (R.). **Etude de tumeurs constatées sur une génisse de la race zebu.** [Tumours in a Heifer of the Zebu Breed.]—*Bull. Soc. Path. Exot.* 1917. Mar. Vol. 10. No. 3. pp. 182–183.

A zebu heifer kept at Zambi showed over a period of two years a large number of warty growths around the anus. These growths spread around the vulva and over the tail and then affected the teats, limbs, and the right auditory meatus. The last-named localisation brought about the death of the animal. The tumours were found to be contagious for the animal itself. The warts were composed of a fibrous base covered with a cluster of small, very fragile, reddish, transparent papillomata from 5 mm. to 1 cm. in length by a few mm. in breadth.

These papillomata are often found as complications of tropical dermatitis in bovines [see above, extract p. 108].

A description is given of the histology of the lesions.

RECENT LITERATURE.

[Continued from this *Bulletin*, Vol. 5, No. 1, pp. 77-84.]

PROTOZOAN PARASITES.

Alexeieff (A.). Mitochondries et corps parabasal chez les Flagellés. [Mitochondria and Parabasal Bodies in Flagellates.]—*C.R. Soc. Biol.*, 1917. Mar. 31. Vol. 80. No. 7. pp. 358–361. With 1 fig.

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Breuer (Rudolf). Fortpflanzung und biologische Erscheinungen einer *Chlamydophrys*-Form auf Agarkulturen. [The Growth and Biological Phenomena of a Chlamophrys Organism on Agar.]—*Arch. f. Protistenk.*, 1916. Aug. Vol. 37. No. 1. pp. 65–92. With 2 text figs. & 1 plate.

Comadon (J.). Phagocytose in vitro des Hématozoaires du Calfat (enrégistrement cinematographique). [Phagocytosis *in vitro* of the Haematozoa of the Java Sparrow. (Cinematographic representation.]—*C.R. Soc. Biol.*, 1917. Mar. 17. Vol. 80. No. 6. pp. 314–316. With 1 plate comprising 2 figs.

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—— & Hesse (E.). Sur les Microsporidies de la crevette d'eau douce. [The Microsporidia of the Fresh-Water Prawn.]—*C.R. Soc. Biol.*, 1917. Jan. 6. Vol. 80. No. 1. pp. 12–15. With 6 figs.

—— & Hollande (A. C.). Sur un nouveau protiste à facies de *Chytridiopsis*, parasite des ovules de l'huître. [A New Protozoon resembling Chytridiopsis, a Parasite of the Ovules of the Oyster.]—*C.R. Soc. Biol.*, 1917. Jan. 20. Vol. 80. No. 2. pp. 61–64. With 4 text figs.

Keilin (D.). Une nouvelle entamibe, *Entamoeba mesnili* n. sp., parasite intestinal d'une larve d'un diptère. [A New Entamoeba, *E. m.*, an Intestinal Parasite of a Dipterous Larva.]—*C.R. Soc. Biol.*, 1917. Feb. 3. Vol. 80. No. 3. pp. 133–136. With 25 figs.

Pascher (A.). Rhizopodialnetze als Fangvorrichtung bei einer plasmodialen Chrysomonade. [Trap Apparatus in the Form of Rhizopodial Threads in a Plasmodial Chrysomonad.]—*Arch. f. Protistenk.*, 1916. Aug. Vol. 37. No. 1. pp. 15–30. With 6 text figs. & 1 coloured plate.

——. Fusionsplasmodien bei Flagellaten und ihre Bedeutung für die Ableitung der Rhizopoden von den Flagellaten. [Fusion Plasmodia in Flagellates and their Significance regarding the Origin of Rhizopoda in Flagellates.]—*Ibid.* pp. 31–64. With 20 text figs. & 1 coloured plate.

Poche (Franz). Die Verwandtschaftsbeziehungen der vermeintlichen Gregarine *Microtaeniella clymenellae* Calk. [Relationships of the supposed Gregarine *M. c.*]—*Arch. f. Protistenk.*, 1916. Aug. Vol. 37. No. 1. pp. 6–14.

Sangiorgi (Giuseppe). Sulla cultura in vitro degli spironemi dell' intestino umano. [Cultivation in vitro of Spirochaetes from the Human Intestine.]—*Pathologica*, 1917. Feb. 15. Vol. 9. No. 198. pp. 61–62.

Shortt (H. E.). Notes on Two Haemogregarines of Cold-Blooded Vertebrates.—*Indian Jl. Med. Res.*, 1917. Jan. Vol. 4. No. 3. pp. 402–413. With 2 coloured plates.

Swellengrebel (N. H.) & Schiess (J. R.). Quelques remarques sur la morphologie de l' *Entamoeba histolytica* et la valeur diagnostique de l'infection rectale des chats. [Some Remarks on the Morphology of *E.h.* and the Diagnostic Value of Rectal Inoculation of Cats.]—*Bull. Soc. Path. Exot.*, 1917. Jan. Vol. 10. No. 1. pp. 13–17. With 4 text figs.

Watson (Minnie E.). Observations on Polycystid Gregarines from Arthropoda.—*Jl. Parasit.*, 1916. Dec. Vol. 3. No. 2. pp. 65–75. With 1 plate.

METAZOAN PARASITES.

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v. KEMNITZ (G. A.). Untersuchungen über den Stoffbestand und Stoffwechsel der Larven von *Gastrophilus equi* (Clark), nebst Bemerkungen über den Stoffbestand der Larven von *Chironomus* (spec.?) L. (Physiologischer Teil). [Investigations on the Nature of and Changes in the Composition of the Larva of *Gastrophilus equi* with Remarks on the Nature of the Larva of *Chironomus* sp.]--*Zeitschr. f. Biologie*, 1916. Dec. 16. Vol. 67. Nos. 3, 4 & 5. pp. 129–244. With 2 plates and 5 text figs.

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[This is for the most part a résumé of a previous paper that was pretty fully extracted in the preceding number of this *Bulletin*.]

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TROPICAL DISEASES BUREAU.

TROPICAL VETERINARY BULLETIN.

VOL. 5.] 1917. [No. 3.

DISEASES DUE TO PROTOZOAN PARASITES.

(a) LEISHMANIASIS.

LAVERAN (A.) & HAVET (J.). **Contribution à l'étude de la leishmaniose viscérale naturelle du chien.** [Natural Leishmaniasis of the Dog.]—*Bull. Soc. Path. Exot.* 1917. May. Vol. 10. No. 5. pp. 386–392. With 1 fig.

A young bitch inoculated intravenously with the bone marrow of a dog infected with naturally contracted canine leishmaniasis (first passage from a dog received from Tunis) died 117 days after inoculation. Death occurred as the result of abdominal haemorrhage due to rupture of the spleen capsule; post-mortem examination revealed very noteworthy lesions in the spleen and liver.

The spleen weighed 345 grammes, that is, about 17 times the normal weight of the spleen of a dog weighing 10 kilogrammes. A rupture of the capsule was found on the external surface of the organ; the parenchyma was much softened and contained a haemorrhagic centre and two infarcts. The liver was larger and lighter in colour than normal; the bone marrow was red and diffluent.

Microscopic examination showed very considerable numbers of Leishmania in the bone marrow, in the spleen, and in the liver.

In the bone marrow the Leishmania were found free-lying or enclosed within the cellular elements, principally the bone marrow cells, and sometimes within the nuclei of these cells.

In the spleen the leucocytes principally contained the parasites; the connective tissue cells and the endothelial cells of the capillaries were also found invaded. Sometimes Leishmania were found in the interior of the nuclei of the cells.

In the liver the hepatic cells were observed to be the predilection seat of the parasites. Leishmania were also found in connective tissue cells, in plasma cells, and in the capillary blood vessels but to a far less extent. The authors' observations do not agree upon this point with those of CHRISTOPHERS and of STATHAM; according to these observers the predilection seat of Leishmania in human kala azar is the endothelial cells of the capillary blood vessels. Marked alterations were found by the authors in the structure of the liver.

LAVERAN (A.). **Boutons d'Orient expérimentaux chez un** *Cercopithecus mona* **et chez un** *Cercocebus fuliginosus*. [The Production of Experimental Oriental Boils in a *C.m.* and a *C.f.*]—*Bull. Soc. Path. Exot.* 1917. April. Vol. 10. No. 4. pp. 291–293.

In this short article Laveran describes observations dealing with the experimental transmission of *Leishmania tropica* from an infected mouse to two more species of monkeys; the author had already effected transmission to four species. The two monkeys now experimented on were inoculated on the outer surface of the right thigh and both developed very marked oriental boils, thus producing as satisfactory a result as in the case of the monkeys previously tested. It was interesting in the case of the *Cercocebus fuliginosus* or "mangabey," which appears to be immune towards *Trypanosoma gambiense,* to find out whether the inoculation of oriental boil would succeed as well as in the case of the species already known to be sensitive to this virus and to *T. gambiense*.

LAVERAN (A.). **Boutons d'Orient chez un Mandrill.** [Oriental Boils in a Mandrill.]—*Bull. Soc. Path. Exot.* 1917. June. Vol. 10. No. 6. pp. 455–456.

In this note Laveran announces the infection of another species of monkey with *L. tropica* from infected mice. The mandrill (*Mormon maimon*) was inoculated in the usual way by puncturing the skin three times on the outer surface of the right thigh. Six days afterwards small hard swellings appeared containing numerous Leishmania. The boils increased in size and in three weeks were about the size of large peas and began to ulcerate. Later, the boils increased further in size, became extensively ulcerated, and suppurated; the parasites became fewer and presented a degenerated appearance. After a month the swellings diminished in size, the parasites disappeared, until in six weeks time the lesions had become cicatrised, leaving only small intradermal thickenings.

(b) SPIROCHAETOSIS.

LEGER (André) & LE GALLEN (R.). **Spirochétose des poules au Sénégal. Son évolution clinique.** [Fowl Spirochaetosis in Senegal. Its Clinical Course.]—*Bull. Soc. Path. Exot.* 1917. June. Vol. 10. No. 6. pp. 435–438.

The above disease is a very common and serious affection among fowls in Senegal causing great losses during the dry season and becoming less intense or even disappearing at the commencement of the rainy season. The causal organism is *Spirochaeta neveuxi* Brumpt, 1909, an organism almost identical in appearance with the ordinary *Sp. gallinarum* but differing from it inasmuch as immunity set up against the one organism does not protect against infection by the other. The pathogenicity of the spirochaete studied by BRUMPT differs a little from that of the authors' organism in that recovery is not the rule.

Twenty-five susceptible young fowls, free from Argas, placed in an infected run, commenced after a period of from five to seven days to show the usual symptoms, viz., more or less intense diarrhoea, depression, inappetence, fever, feathers erect and dirty-looking, and dull and flabby comb. Microscopic examination of the blood revealed numerous spirochaetes, but the mortality at this stage was inconsiderable; two pullets only succumbed.

The course of the disease thenceforward may lead directly towards recovery; thus four fowls after presenting spirochaetes in their blood for from seven to eight days afterwards showed no abnormality and became definitely cured. Generally, however, after the onset of the crisis the condition of the animal changes, becoming slightly better. The appetite improves a little and the diarrhoea is markedly lessened. There only remains a condition of intense anaemia. This stage lasts about a fortnight, then a number of secondary symptoms set in, and at the same time the red blood corpuscles show a number of the so-called "after-phase" bodies of BALFOUR.

In this secondary stage one may observe symptoms of two different degrees of severity. In the first place, the wasting may become progressive in spite of the appetite having recovered, the comb becomes covered with crusts which gradually extend over the whole head especially along the eyelids, and underneath these crusts, which are easily separated, are seen smooth ulcers exuding a serous liquid. Symptoms of partial paralysis also set in but these are usually transitory. Four out of 19 pullets which had arrived at this stage recovered.

In the second place, the above symptoms may continue to progress; the ulcerations affecting the head spread down the neck, and similar lesions develop on the breast and legs. A stinking viscous liquid flows from the beak, the eyelids become closed and underneath them a white caseous mass about the size of a hazel nut becomes formed and produces marked changes in the eye itself on account of pressure. In spite of the absence of fever the animal becomes extremely emaciated, but the appetite remains only slightly diminished. This second stage does not generally last more than from four to five months; 12 out of 15 pullets then died and 3 only survived; in spite of their serious condition the latter became completely cured.

BLANCHARD (R.). **Spirilles et Spirochètes.** [Spirilla and Spirochaetes.] —*Bull. Acad. Méd.* 1916. Nov. 7. Extracted in *Rec. Méd. Vét.* 1917. Apr. 15–May 15. Vol. 93. Nos. 7 & 8. pp. 225–226.

"The relationship existing between spirilla and spirochaetes is still the object of discussion. According to the author spirilla are large bacteria belonging consequently to the vegetable kingdom and live as saprophytes in water rich in organic matter. None of them is pathogenic or parasitic and in the actual state of knowledge there is no known spirillosis in man or in any animal.

"Spirochaetes are found in the bodies of man and of different animals; a large number are pathogenic and cause severe diseases, which are *spirochaetoses* (for example, recurrent fever, tick fever, ictero-haemorragica, syphilis). In spite of their resemblance to spirilla spirochaetes have the greatest affinities with the protozoa; they would thus belong to the animal kingdom. With the exception of syphilis spirochaetoses are inoculated diseases transmitted from one individual to another by the bite of an arthropod (acarian or insect).

"The conclusions of the distinguished professor are as follows:—

"(1) Spirilla should not be confused with spirochaetes as is done by a large number of authors.

"(2) The spirilla are neither pathogenic nor parasitic; a large number of spirochaetes are parasitic and pathogenic.

"(3) All the diseased conditions attributed to spirilla are due to spirochaetes. One knows of multiple examples of spirochaetoses; one does not know at present of any spirillosis, even on taking into consideration the whole animal series.

"(4) To speak in human or comparative pathology of spirilla and of spirillosis in cases of spirochaetes and spirochaetosis is not only to commit an error in language but also to ignore zoological and botanical nomenclature, without the observance of which scientific language could not attain rigorous precision; it amounts to breeding or maintaining inaccurate scientific notions which are very prejudicial to the progress and diffusion of science."

LEGER (André). **Spirochète de la musaraigne (*Crocidura Stampflii* Jentink).** [A Spirochaete of the Shrewmouse.]—*Bull. Soc. Path. Exot.* 1917. Apr. Vol. 10. No. 4. pp. 280–281.

Leger adds still another spirochaete to the list of those already found in the blood of mammals. The insectivorous host was caught in the sewers of Dakar, French Senegal. In the blood the spirochaetes were fairly numerous (1 per 15 fields of the microscope, $\frac{1}{15}$ inch Stiassnie lens) and presented fairly active movements. The organism was on an average from 14 to 16μ in length by about ·25μ in breadth and possessed four or five spirals; after staining it was seen as a straight or slightly curved spiral filament with whip-like extremities. The spirals were generally irregular in size measuring 2μ in width by 1 to 1·5μ in depth. Blood examination also revealed a large number of *Anaplasma marginale* and a very few parasites of the genus Grahamella. The pathogenicity of the spirochaete will be described later by the author. The name *Spirochaeta crocidurae* is given to the organism.

CARPANO (Matteo). **Su di uno spirochete osservato nel topo bianco (*Mus rattus* var. *alba*) e qualche considerazione su alcuni spirocheti saprofiti.** [A Spirochaete Observed in the White Rat and some Considerations on Certain Saprophytic Spirochaetes.]—*Nuovo Ercolani.* 1917. May 15 & 31. Vol. 22. Nos. 9 & 10. pp. 141–146 & 163–168. With 2 text figs.

A white rat which had been inoculated intraperitoneally with a broth culture of a streptococcus died after two days with lesions of intense peritonitis. In the peritoneal exudate, besides abundant streptococci, there was a considerable number of spirochaetes, some occurring singly, some in process of division, and some in clumps. In fresh preparations a number appeared to execute rather active movements while others were almost non-motile. The movements were of three types, propeller-like, serpentine, and a motion of contraction and expansion like the uncoiling of a spring.

The organisms were stained with difficulty; Ziehl's carbolfuchsin diluted and slightly heated, and Giemsa 1 in 10 applied for about 12 hours, gave the best results. When stained, single spirochaetes measured from 5 to 12μ by ·25μ in thickness and usually possessed from two to three large spirals. S-shaped and other forms were seen. The ends were often sharp but in some cases one end was apparently blunted. The interior often appeared to contain elongated granules with a nuclear appearance. Traces of a lateral membrane could be seen in some. There were no visible lateral or terminal cilia. Reproduction appeared to take place by transverse fission but a few elements appeared coupled closely parallel to each other. Spindle-shaped bacillary forms were also observed in the peritoneal exudate.

In the heart blood a few very scanty spirochaetes similar to those found in the peritoneal exudate were discoverable, but no spindle-shaped elements could be seen.

In the gastric and intestinal contents of this animal numerous spirochaetes were found of two distinct types, (1) stumpy elements from 6 to 12μ in length by 1μ in breadth with three or four shallow spirals and rounded ends, and (2) more numerous elements of the same nature as those seen in the peritoneal exudate and in the blood. In healthy rats belonging to the same lot as the above rat numerous microscopical examinations failed to reveal spirochaetes in the circulating blood; they were, however, easily distinguishable in the gastro-intestinal contents, especially in the caecum. Inoculation of a loopful of the peritoneal exudate from the dead rat into a healthy white rat produced no effect.

The author proceeds to discuss at length the significance of this secondary invasion with spirochaetes supervening on a streptococcic infection. A list of spirochaetes discovered by various authors in animals in health and disease is given. The author believes that many of these spirochaetes live normally as saprophytes in the digestive, excretory, or respiratory tract of animals, but probably play a considerable rôle as secondary invaders when the resistance of the membranes has been lowered by some disease-producing agent. The case of spirochaetes in the lesions of pigs infected with swine fever is quoted as one example.

(c) PIROPLASMOSES.

YAKIMOFF (W. L.), SCHOKHOR (N. J.), KOSELKINE (P. M.) & PAROÏSKY (P. S.). **Maladies animales du Turkestan russe à parasites endoglobulaires.** [Animal Diseases caused by Intracorpuscular Parasites in Russian Turkestan.]—*Bull. Soc. Path. Exot.* 1917. Apr. Vol. 10. No. 4. pp. 302–311.

The following are results published by the Commission appointed for investigating human and animal tropical diseases in Russian Turkestan, sent by the George Speyer Institute, Frankfort-on-Main, the Imperial Institute of Experimental Medicine of Petrograd, and the Veterinary Department of the Ministry of the Interior, Russia.

Piroplasmoses.—Bovine piroplasmosis had been recorded in Turkestan by KOVALEVSKY and STOLNIKOFF, but these authors probably confused two distinct diseases—piroplasmosis and theileriasis—as well as some bacterial diseases, as blood examinations were not always made; in one outbreak a mortality of 61·5 per cent. was recorded. Bovine piroplasmosis was identified by Yakimoff and his co-workers in two localities, the symptoms being similar to those of redwater in other countries. The *P. bigeminum* presented the usual morphological characters: pear-shaped forms 1·42 to 2·13μ × 1 to 1·42μ, round forms 1·4 to 2·13μ. Trypan blue gave very good results in the treatment of affected animals. Twenty-five cc. of a 1 per cent. solution in normal saline were injected; a total dose of from two to three grammes was sufficient even in the acute form. The parasites disappeared from the blood within 12 hours and the temperature came down. The cure was complete.

Equine piroplasmosis has existed for a long time in several localities in Turkestan. KOVALEVSKY (1909) discovered small round-shaped blood parasites characteristic of piroplasmosis on post-mortem examination of a horse. The authors themselves identified two species of parasites, viz., *Piroplasma caballi* and *Nuttallia equi.* The symptoms of the disease caused by *P. caballi* are fever, up to 41·4° C., pulse up to 100, thready in some cases, respiration up to 40 and of the abdominal type, loss of appetite, and depression; the eyelids are half closed, and sometimes there is lachrymation and petechiae on the conjunctival mucous membrane. The mucous membranes are coloured more or less yellow; the urine is thick and of a dark-yellow up to a reddish-brown colour; sometimes it contains albumin. The percentage of haemoglobin may fall down to 35. Decomposition sets in quickly after death and the fat and the serous membranes are stained yellow; there is then seen congestion of the internal organs, enlargement of the spleen, and serous exudate within the pericardial sac. The *P. caballi* of Turkestan was similar to that of other countries—single and bigeminate pear-shaped forms and rounded parasites.

In sheep the authors discovered piroplasms and Theileria in the case of slaughterhouse animals. Cases due to piroplasms were rarer than those due to Theileria. The piroplasms were of the large pear-shaped form and there was never more than one parasite in a single red corpuscle.

DSCHUNKOWSKY and LUHS (1907) first observed ovine piroplasmosis in the Transcaucasus, where the disease causes great losses. Yakimoff believes that according to the figures published by these two authors they were dealing with a mixed infection due to piroplasms and Theileria. The same authors (1909) discovered in the Transcaucasus a disease of goats in which they described small rounded-oval or elongated-oval parasites smaller in size than those found in sheep. It is probable that these also were not piroplasms but Theileria. SCHELLHASE (1913) described cases of goats infected with parasites of the type *Theileria mutans* in German East Africa. In a single case Yakimoff discovered a fairly large intracorpuscular parasite resembling a piroplasm in the blood of a goat in Turkestan.

The blood and spleens of a large number of dogs in several towns were examined but no case of piroplasmosis was discoverable.

On the other hand, piroplasmosis appears to be very widespread among wolves. In the slaughterhouse at Taschkente 75·9 per cent. were found infected. The degree of infection varied; as a rule the infection was latent and the parasites very rare. The parasites occurred as ring-shaped, small pear-shaped, and rarely rod-shaped forms; elements in the form of a Maltese cross were seen. Theileria and anaplasms were observed in conjunction with the piroplasms. The average size of the piroplasms was in the case of the rounded forms 1·42, bacillary forms 2·13, pear-shaped forms 1·5μ. Sometimes eight parasites could be seen in one corpuscle. In the case of one wolf killed on the Afghan frontier parasites resembling *P. canis* were found. It is recalled that NUTTALL and GRAHAM-SMITH failed to infect jackals with *P. canis.* PATTON (1910) discovered piroplasms, *P. gibsoni,* in Madras jackals and dogs, and NUTTALL (1910) found a piroplasm, *P. rossi,* in an African jackal.

Theileriases.—The authors noted some acute cases of theileriasis in bovines. Two animals were seen with a high temperature and general depression, but no other symptoms. Eighty per cent. of the red corpuscles were found invaded on examination of blood smears. After a few days the temperature became gradually lower and the number of parasites diminished but they did not disappear completely. In Turkestan there thus exist two forms of theileriasis, viz., an acute and a chronic form; the former lasts a few days and then becomes chronic; in the latter condition the parasites did not disappear entirely from the blood. The mild nature of the disease and the presence of parasites in the blood of healthy animals indicate that the Theileria of Turkestan is not *Th. parva*, but perhaps *Th. mutans* or a variety of this species. Calves inoculated with large quantities of infected blood developed in a few days a small number of Theileria which persisted but did not increase in number. Neosalvarsan and trypan blue injected intravenously failed to cause the disappearance of the parasites.

Theileria were found in smears from the blood of sheep killed at the Taschkente abattoirs. They were oval or pear-shaped in form, 1·5μ in length, with a small chromatin dot; rod-shaped parasites were very rare. Similar parasites have been described in sheep by SCHELLHASE (1913) in German East Africa, by MACFIE (1914) in Nigeria, and RODHAIN (1916) in the Belgian Congo. They were called *Theileria ovis* by the last-named author, and also prior to that date by Yakimoff in 1914.

Blood parasites which were believed to be Theileria (*Th. camelensis*) on account of their morphological characters were found in the blood of three camels. They were rounded in form with lightly staining reddish chromatin, few in number, and always occurring singly.

In the blood of one fox out of several examined a few Theileria were found in the form of rings each with a mass of chromatin.

Nuttalliases.—Several cases of nuttalliasis either alone or associated with piroplasmosis were found among horses. Clinically there was high temperature up to 41° C. or more, accelerated pulse (100), depression, jaundice, but no haemoglobinuria as in the case of the infection due to *P. caballi.* In blood smears four parasites were sometimes found together assuming the shape of a Maltese cross. One case was treated successfully by means of trypan blue, although THEILER states that this drug has no action upon *Nuttallia equi.* These parasites were found in about 2 per cent. of the horses killed at the Taschkente abattoirs; they were rounded or ring-shaped, rarely pear-shaped. The round forms were 1·42 to 2·48μ in diameter, the pear-shaped forms 0·71μ to 1·42μ × 1·42μ to 2·13μ. Nuttalliasis was found by DSCHUNKOWSKY and LUHS in the Transcaucasus.

Several cases of nuttalliasis were found among asses in one district. The parasites were rounded or slightly oval, and sometimes pear-shaped. The chromatin was well-developed. No division into four daughter parasites was observed. This disease was also observed in asses by DSCHUNKOWSKY and LUHS in the Transcaucasus.

Anaplasmoses.—Out of 193 bovines examined in one locality Theileria alone were found in the blood smears of 147, Theileria and anaplasms in 13, and anaplasms alone in one case only. The infection in bovines was probably first observed by STOLNIKOFF (1908), who mistook the causal organism for *Piroplasma annulatum*. *Anaplasma marginale* was the only form seen and never *A. centrale*. The parasites were of a regularly rounded shape and occurred singly and, rarely, in twos within the red corpuscles; sometimes forms undergoing division in the shape of a dumb-bell were seen. When associated with piroplasms the anaplasms were rare but they were numerous in the case of pure anaplasmosis. They stained of a deep violet colour with Giemsa, and were from 0·5 to 1·25μ in diameter.

Anaplasms were found in two horses, in one case associated with *N. equi* and in the other case alone. No anaplasms were found in asses.

The first case of anaplasmosis discovered by Yakimoff in dogs was found in a case severely infected with naturally-contracted leishmaniasis. Two other dogs inoculated with an emulsion of the organs of this dog became infected with leishmaniasis but not with anaplasmosis. Several cases of anaplasmosis were afterwards seen in dogs, but never in sheep and goats.

STOUTE (R. A.). **"Piroplasmosis" "Equine Malaria."**—*Jl. Amer. Vet. Med. Assoc.* 1917. May. Vol. 51. (New Ser. Vol. 4.) No. 2. p. 239.

A mare imported into Barbados, West Indies, from St. Croix showed symptoms commencing with inappetence six days after landing; two days later the appetite had disappeared. The following symptoms were then observed:—the conjunctival, buccal, and genital mucous membranes presented a yellow appearance; lachrymation; intermittent hurried pulse; quickened respiration; temperature 108° F.; great disinclination to move; marked constipation. The respiration was very rapid just before death. The blood smears, which were examined by the Bureau of Animal Industry, showed numerous piroplasms. The author is unable to suggest how this disease appeared in the West Indies.

(d) TRYPANOSOMIASIS.

HORNBY (H. E.). **Transmission of Cattle Trypanosomes by Flies other than Tsetse.**—*Rhodesia Agric. Jl.* 1917. Apr. Vol. 14. No. 2. pp. 168–176. With 1 plate comprising 2 figs.

In this article Hornby refers briefly to the existing knowledge with regard to the classification and transmission of trypanosomes. In Central Africa it has been shown that where the tsetse fly exists one always expects to find the domesticated animals affected with trypanosomiasis, and the same applies to Rhodesia. MONTGOMERY and KINGHORN (1908), however, concluded that "trypanosomes may be transmitted by *Glossina morsitans*, *Stomoxys calcitrans*, and a specimen of Lyperosia." BEVAN (1910), on the other hand, maintained that trypanosomiasis did not spread in the absence of the tsetse fly.

The author states that experience with fly-struck cattle in almost every part of N.E. Rhodesia, and in the adjoining parts of N.W. Rhodesia, Nyasaland and Portuguese East Africa has shown him that the vast majority of fly-struck cattle in these areas are infected with *T. pecorum*; only comparatively few were found to harbour *T. brucei* or *T. vivax*, although these trypanosomes are well represented in other parts of Rhodesia. In a district where *T. pecorum* and *G. morsitans* are both common it has been stated that if all the mammals and flies are examined only comparatively few of each lot would be found to harbour trypanosomes, nearly all the infected mammals being ruminants and all the affected flies being Glossina. Further, not all ruminants, nor all tsetse flies are susceptible, and in any fly belt it is exceptional to find more than 50 per cent. of the ruminants and 5 per cent. of the flies infected. Various authors have demonstrated that trypanosomes in other parts of the world can be and frequently are transmitted mechanically by flies other than tsetse flies. It remains to be shown that the Central African trypanosomes are often transmitted in a similar manner. JOWETT (1910 and 1911) showed that outbreaks of trypanosomiasis due to *T. congolense* (*pecorum*) frequently occurred in Portuguese East Africa in localities containing no tsetse flies but into which some animals had been brought from a distance and had been submitted en route to the attack of one or other species of Glossina; he further showed that Stomoxys or Haematopota were capable of transmitting the trypanosome mechanically. OWEN (1914) demonstrated that trypanosomiasis of cattle in N.W. Rhodesia was spread by a species of Tabanus; and JONES (1915) showed that the disease was spread in cattle near Beira by Tabanus or Hippobosca. BALFOUR in the Sudan and BRUCE in Nyasaland were both convinced of the important part that mechanical infection may play in spreading outbreaks due to *T. pecorum*; the latter observer blames Tabanus and Haematopota but considers that the evidence that Stomoxys plays a similar rôle is unsatisfactory. BRAUN (1914) in German East Africa stated that it was possible that in addition to tsetse flies other biting insects (Stomoxys and tabanids) transmitted *T. pecorum* (*congolense*).

In 1914 the author inoculated a dog with a strain of *T. brucei* vel *rhodesiense*; the dog afterwards showed numerous trypanosomes in the blood. The dog was allowed to cohabit with another dog, while the attacks of Stomoxys and haematophagous muscids caused severe excoriation of their ears. The uninoculated dog, subsequently fell ill and blood examination revealed numerous trypanosomes similar to those found in the other animal.

> "The farming district of Fort Jameson is a 'fly-free' area almost completely surrounded by 'fly.' It is not a matter for surprise then that outbreaks of trypanosomiasis are constantly being reported from its periphery. I was soon impressed with the disproportion between the large number of animals affected and the small number (frequently *nil*) of tsetse that had been seen in the neighbourhood of the outbreak. Making all allowances for bad herding and straying cattle, it seemed impossible that, as was frequently the rule, an entire herd of fifty cattle could be infected by tsetse that no one had ever seen. Granted that the initial cause of the outbreak was a beast struck by a stray tsetse, it seemed probable that the disease was spread in the herd by some other agency. Then again, I have travelled through a district in December, just as the rains were starting, and of a thousand village cattle examined I have found less than a dozen to be fly-struck. I have travelled in the same district six months later, and found that five hundred of those previously examined were either dead or very ill from trypanosomiasis—on neither journey did I see a tsetse fly, although I know that from time to time odd ones are to be seen close to the district in question. This seasonal occurrence of the disease, coincident with the biting fly season, is significant."

The author then adds that in other districts where tsetse flies were scanty a large proportion of cattle became affected with trypanosomiasis. As experience has shown that less than 5 per cent. of Glossina are infective the large number of cases could not be entirely attributable to them. On some estates where the danger from mechanical infection has been realised and measures taken to isolate all fly-struck cattle, no fresh cases occurred during the last summer, although during each of the three previous ones severe outbreaks had been the rule.

The following footnote to this article is added by the Chief Veterinary Surgeon, Southern Rhodesia :—

> "With regard to the conclusion that in certain circumstances trypanosomiasis in domestic animals is transmitted by biting flies other than tsetse, whilst this may be true for some areas, it is a very rare occurrence in Southern Rhodesia, where, as the result of the practical observation—no tsetse, no trypanosomiasis—it has not been found necessary to impose any veterinary regulations in respect to this disease."

MAYNARD (G. D.). **The Trypanosomes of Sleeping Sickness; being a Study of the Grounds for the Alleged Identity of *T. brucei* with those causing Disease in Man in Nyasaland.**—*The South African Institute for Medical Research. Publication No. 6.* 39 pp. With 1 table & 26 charts. Dec. 17. 1915. Johannesburg.

This publication consists of a detailed criticism of the findings of the Sleeping Sickness Commission of the Royal Society in its Report No. 16 [see this *Bulletin*, Vol. 3, No. 1, pp. 5–12]. "The Commission having satisfied itself that the Sleeping Sickness of Nyasaland and Rhodesia is caused by a trypanosome which, it states, is common in all fly-country and is spread from wild animals to man, recommends that efforts should be made to diminish, as far as possible, the number of wild animals in fly-areas."

Reference is made to the difficulties involved in exterminating game from the known African fly-areas and for the above recommendation to be valid two suppositions must be confirmed, viz. :- "(*a*) that wild game in all districts where *G. morsitans* is found are carriers of the trypanosome causing human trypanosomiasis, and (*b*) that if the game is eliminated the smaller animals will not act as carriers." Many ambiguities in the Commission's report are revealed by the author, and careful consideration of the far-reaching conclusions is advised before African governments should endeavour to carry them into effect.

The Commissioners consider that the morphology of the trypanosomes studied is a most important point, especially as regards length, and the numerous graphs of frequency-distributions of length-measurements indicate the value they place on this method of examination for the purpose of classification. Maynard points out that in common with other writers they "have discussed this point entirely from an inspectional standpoint, and appear to be unacquainted with the methods of the scientific analysis of such distribution, or of the statistical laws on which alone can sound deductions as to similarity or dis-similarity be based."

Karl PEARSON had already pointed out the great chances of error that might arise when trypanosomes are considered to be identical simply according to the method adopted by Bruce and his colleagues. The greater part of the present paper is devoted to an intricate mathematical analysis, on the same lines as suggested by Pearson, of the graphs of the various trypanosomes given in the Commission's report.

The author concludes from this study—

> "1. That the analysis of length distributions shows that the dimorphic trypanosomes dealt with, viz., *T. rhodesiense*, *T. brucei*, *T. gambiense*, Trypanosomes of Nyasaland Sleeping Sickness, and Nyasaland wild game strain, have certain features in common. With some exceptions, which are not confined to any particular strain, the general character of resolution is similar.
>
> "2. That there is some evidence to suggest that there is less similarity between the Nyasaland human strain and *T. brucei* than between *T. rhodesiense* of Stephens and Fantham and *T. gambiense* as recorded by these authors.
>
> "3. That the analysis suggests that uniformity in treatment of strains, prior to the inoculation of rats, from which measurements are made, may be an important factor in determining the mean size and the variability of the components of the distributions.
>
> "4. That at present no valid argument in regard to the identity or otherwise of *T. brucei* and the trypanosome causing disease in man in Nyasaland can be drawn from length-measurement-distributions.
>
> "5. That this method of investigation may probably prove of service in the study of trypanosome species when proper analytical methods are employed at the time the investigations are being undertaken, but that nothing of value can be expected from an uncritical examination, or mere inspection, of the crude distributions."

The pathogenicity tests on laboratory animals of the various strains of trypanosomes studied by the Commission are then discussed and from the data the author infers "that at present the only valid argument in favour of the identity of the trypanosomes causing disease in man in Nyasaland with *T. brucei* is to be drawn from such experiments. There is some doubt, however, as to what weight should be attached to differences in period of illness before death, and, moreover, whether any stress should be laid on similarity in this respect in the absence of confirmation by other methods of investigation."

No differences in the trypanosomes can be noted by studying the carrier question. *T. rhodesiense* may be carried by *G. morsitans* and *G. brevipalpis*, *T. brucei* by *G. morsitans* and *G. pallidipes*, *T. gambiense* by *G. palpalis* and *G. morsitans*. The cycle of development in *G. morsitans* is similar for *T. brucei*, *T. rhodesiense* and *T. gambiense*.

With regard to cross immunity tests the experiments carried out by the Commission indicate that *T. brucei*, the Nyasaland human strain, the Nyasaland wild *G. morsitans* strain, and *T. rhodesiense* were not identical. Moreover, experiments carried out in the same direction by Laveran and Nattan-Larrier and Mensil and Leger tended to show that *T. rhodesiense* is not the same as *T. brucei*, and that a closer relationship exists between *T. gambiense* and *T. rhodesiense* than between *T. brucei* and either of these trypanosomes. Such experiments on the effects of various immune sera as have been undertaken "negative the supposition that *T. brucei* is identical, or even closely allied to the trypanosome causing Sleeping Sickness in man."

The importance attached to geographical distribution is indicated by the following quotation:—"The Commission thinks that, in addition to the morphology and action on animals, the geographical distribution of 'Nyasaland sleeping sickness,' or '*Trypanosoma brucei* disease' is the only way—experiments on man being impracticable—of showing that *Trypanosoma brucei* and *Trypanosoma rhodesiense* are one and the same." The author states—

"9. That there is no evidence at present from the known geographical distribution of *T. brucei* to suggest that it is a cause of Sleeping Sickness in man; and that even if it were found to produce disease in man this would, of itself, constitute no greater argument in favour of its identity with the Nyasaland human trypanosome than with *T. gambiense*.

"10. From the foregoing it would appear, therefore, that there is very little scientific evidence to support the contention that *T. brucei* and the trypanosome causing Sleeping Sickness in Nyasaland are the same species, while there are some very valid reasons for regarding them as distinct. Although the question may still be considered *sub judice* there does not seem to be any justification for entertaining a bias in favour of their identity. If this be admitted it follows that the recommendations of the Commission, which are based on their assumed identity, do not rest on a sure foundation of fact."

The author then enumerates a few hypotheses which suggested themselves in the course of this study as possible explanations of some of the facts. A priori it is unlikely that the Nyasaland human trypanosome is a newcomer into the country and thus it may be that (1) the Nyasaland disease is caused by the *T. gambiense* and that the increased virulence is due to the change of the invertebrate host, (2) that the human strain is derived from the wild game strain of the country, and (3) that it is the result of a dual infection with say, *T. gambiense* and a game strain. Various arguments in favour and against these theories are brought forward.

"It may be pointed out that unless an unmodified game strain be the cause of human trypanosomiasis—and the weight of evidence appears to me to be against this view—the human carrier is of much greater importance than the wild animal, and consequently the recommendations of the Commission cannot, unless considerably modified, be accepted as a satisfactory solution. The wholesale destruction of the big game of Africa cannot be accomplished without profoundly affecting the economic position in this Continent, nor, even if it could be satisfactorily carried out, can any positive guarantee at present be given that the situation in regard to Sleeping Sickness would be improved."

TEICHMANN (Ernst). **Mischinfektionsversuche mit Trypanosomen.** [Mixed Infections with Trypanosomes.]—*Zeitschr. f. Hyg. u. Infektionskr.* 1916. Nov. 23. Vol. 82. No. 3. pp. 511-526. With 6 tables.

"The manner in which mixed trypanosome infections behave in mice was first investigated by A. LAVERAN and D. ROUDSKY (1912). They obtained strains without centrosomes from *Trypanosoma brucei*, *Trypanosoma evansi*, and *Trypanosoma soudanense* by the action of oxazine on these parasites. Such parasites mixed with normal individuals of the same strains were completely eliminated in from 2 to 10 mice passages. Afterwards R. OEHLER (1914) showed experimentally how artificially mixed infections with trypanosomes conducted themselves in mice. OEHLER obtained a pure strain by means of single cell transmission of a nagana strain (No. 4) maintained in our Institute. One branch of this strain was made drug-fast against salvarsan and another against tartar emetic, while another was not treated and thus remained sensitive to drugs. Each of the drug-fast subsidiary strains were then mixed with the drug-sensitive strain, inoculated into mice, and then carried on in these animals. In the course of passages the trypanosomes became separated and it always happened that the drug-fast components of the mixed infection gradually disappeared. OEHLER makes the difference in multiplication responsible for the separation and he expresses the opinion that all acute strains 'that have been carried on for several passages must be regarded as pure—as pure as if they had originated from a single trypanosome.' "

It was obvious that in the course of passages a more quickly multiplying strain would ultimately lead to the suppression of a more slowly dividing trypanosome provided that the greater multiplication was also combined with stronger virulence. The question arises, however, as to what would happen in the case of a mixed infection with two or more strains possessing approximately the same power of multiplication and toxicity. The experiments described by the author in this paper were performed with the object of solving this problem.

Two nagana strains named Strain 4 and Strain 90 Fl., respectively, were used; these had been maintained in rats or mice and possessed approximately the same virulence in that they both killed mice in from four to six days after inoculation. Neither of these strains had been submitted to the action of any drug but Strain 4 had been shown to be very insensitive towards arsenic, while the other strain remained quite sensitive. The two strains also possessed immunological differences in that a serum immune against one strain had no protective powers against the other. Equal quantities of these two strains were then inoculated into five mice and a series of the passages made from each of these mice. At various passages the nature of the infective organisms was ascertained by determining the curative action of the sera immune against each of the original components on inoculated mice; the arsenic-fastness of the organisms was also tested by injection with arsacetin. At the 6th passage both elements were present in every case. In the case of one of the mixed strains the arsenic-fast element had become eliminated in the 10th passage; in the case of the other three mixed strains carried on both elements remained for a longer time, but at the 20th or 21st passage it was found that only the arsenic-fast strain remained; the remaining mixed strain was lost.

In order to make sure that one element had not been missed because of the small number present in the peripheral blood experiments were next made using for transmission the heart blood of infected mice 24 hours after inoculation, and tests were made at various passages as before. Separation, however, took place in the same way, but after a greater number of passages and this would probably be accounted for by the fact that the passages were made more quickly.

The question now arose as to whether a separation would take place in the case of two equally virulent trypanosome strains which set up a chronic infection after inoculation into mice. Tests by means of specific immune sera would not be possible in this case as the strains undergo marked antigenic changes in the course of a chronic infection. It is, however, possible to perform the experiment by utilising two trypanosomes which present morphological differences. Thus, a strain of *T. brucei* (Strain 63) obtained by the author from an ox in German East Africa, and the small East African trypanosome, *T. congolense* (Strain B), were used. Both these strains took about 30 days to kill a mouse; the remission period occurred earlier, about the 7th day, in *T. brucei* than in the case of *T. congolense*, 14th to 16th day. Mice inoculated with equal quantities of these chronic strains were examined daily as to the relative proportion of large and small trypanosomes in the blood. Sub-inoculations were made when they were present in equal quantities and also when one element considerably exceeded the other or was apparently absent under the microscope. In the case of the mixed strain obtained from one mouse separation occurred rather early, but in the case of the other four mixed strains it was not possible to obtain any separation although the experiments were carried on over three months.

Mixed infections are known to occur naturally. YORKE and BLACKLOCK (1911) observed a horse infected with *T. vivax* and *T. dimorphon*. BRAUN and TEICHMANN produced a mixed infection with *T. brucei* and *T. congolense* by feeding Glossina on rats at Amani, German East Africa.

The following are briefly the author's conclusions :—

"(1) In the case of a mixed infection with two equally virulent acute nagana strains separation takes place in the course of a few passages through mice.

"(2) The separation may take place by the elimination of one or other component.

"(3) Difference in sensitiveness of the components towards arsacetin exercises no appreciable influence on the direction in which the separation may take place.

"(4) The separation of two equally virulent nagana strains is also not prevented if the heart blood of the mice infected with the mixed strains is used for sub-inoculation.

"(5) In the case of mixed infection with strains (*T. brucei* and *T. congolense*) producing a chronic disease in mice separation of the components does not take place in consequence of the remissions which occur.

"(6) Exceptionally a separation can take place if one of the two components is indeed carried over in the course of sub-inoculation, but does not infect."

YAKIMOFF (W. L.) & WASSILEVSKY (W. J.). **Essais biologiques sur le luargol (102 de Danysz). Traitement de la dourine expérimentale des souris.** [Biological Tests on Luargol (Danysz's 102). Treatment of Experimental Dourine of Mice.]—*C. R. Soc. Biol.* 1917. Apr. 21. Vol. 80. No. 8. pp. 387–388.

The effects of luargol (an organic arsenical compound containing antimony, bromine, and silver) as well as its disodic compound were examined by the authors on normal mice and on mice infected with the Russian strain of dourine. It was found that 1 cc. of a 1 in 250 solution when injected intravenously killed normal mice in two days after injection, but that mice survived the injection of 1 cc. of weaker solutions, 1 in 300 to up to 1 in 800. The minimum fatal dose was thus 4 mgm. for a mouse weighing 20 grammes, and the maximum dose tolerated 3·3 mgm. These results indicated that luargol is less toxic than German and Russian salvarsan.

Mice infected with dourine, injected intravenously with solutions of 1 in 600 up to 1 in 900, recovered and were kept under observation afterwards for 60 days. In the case of infected mice treated with weaker solutions, 1 in 1,000 to 1 in 2,000, relapses occurred in from 11 to 20 days. The therapeutic dose was thus 1 cc. of a 1 in 900 solution, or 1·1 mgm.

The therapeutic index or the ratio between the minimum curative and the maximum tolerated dose is thus 1 : 3, which is better than that of salvarsan. The authors conclude that 102 is a very good chemo-therapeutic agent.

WEHRBEIN (Heinrich). **Die Diagnose der Beschälseuche mittels der Konglutinationsmethode.** [The Diagnosis of Dourine by Means of the Conglutination Method.]—*Arch. f. Wiss. u. Prakt. Tierheilk.* 1917. Apr. 14. Vol. 43. Nos. 2 & 3. pp. 233–238.

The conglutination test closely resembles the deviation of the complement test except that in the final reading clumping of the blood corpuscles instead of haemolysis serves as the indicator. The test was studied by STRANIGG as applied to the diagnosis of glanders and it was also applied by EHRLICH, BORDET, and STRENG to detect the presence of antibodies against various bacteria and other albuminous products.

Careful titration of the various reagents is necessary. The author uses fresh horse serum as complement. This loses its activity on standing after six to seven hours but in the case of a healthy horse its titer remains constant and need not be determined for each experiment. A horse is selected possessing a serum with the highest complement titer. Some horse-sera agglutinate the corpuscles to a high degree and should be avoided.

The sheep blood emulsion should be of constant thickness and is added in the proportion of 0·1 of a 5 per cent. emulsion.

The antigen consists of pure trypanosomes obtained by repeated centrifugation from the blood of infected rats. An emulsion of 1 in 100 is made up.

A suitable ox serum must be obtained for conglutinating the sheep blood corpuscles. The best titer is 0·1 when 0·1 horse-serum is used as complement with 0·1 of a 5 per cent. emulsion of sheep corpuscles.

The reaction is usually read off three hours after the addition of the inactivated ox serum and the sheep corpuscles. The suitability of each lot of antigen is tested with a serum from a known dourine-infected horse and from a known normal horse.

The serum to be tested must be sterile. Putrefaction or the addition of chemicals is fatal to the test. The sera are inactivated for half an hour at 59° C.

The reading of the test is easy in a good system. With a positive result all the corpuscles are clumped together and with a negative serum there is no trace of clumping.

Nineteen dourine sera gave positive results corresponding with those given by the ordinary deviation of the complement test, and to a large extent with the agglutination test, with one exception in which an animal that had been infected for a considerable time and had then been treated with atoxyl ceased to give a positive result with the complement test, but continued to react strongly according to the conglutination test. Thirty normal sera gave negative results, except at first in two cases where errors of technique were detected.

The author's conclusion to a very incomplete description of his test is as follows:—

> "The conglutination test is applicable for the diagnosis of dourine sera, but it is more sensitive to errors, and therefore more difficult to carry out than the ordinary deviation of the complement method."

DYKINS (W. A.). & JONES (R. P.). **Experiments conducted with a View to ascertaining the Toxicity of Certain Drugs injected Intravenously, and the Action of Same, if any, on Trypanosomes causing Trypanosomiasis in German East Africa.**—*Vet. Record.* 1917. Apr. 7. Vol. 29. No. 1500. pp. 415-416.

Nearly all the animals of the regiments in the veterinary charge of the authors were infected with trypanosomiasis, and, as no hope was entertained of their recovery, some experiments were performed on animals in the last stages of the disease with the object of ascertaining the minimum toxic doses of certain drugs when administered intravenously.

No toxic effects were observed after the administration of 25 grains of arsenic, 500 cc. of a 1 in 1,000 solution of perchloride of mercury, fifteen grains of arsenic and 200 cc. of a 1 in 1,000 solution of perchloride of mercury, 150 cc. of a 2 per cent. solution of calx chlorinata, 100 cc. of hypochlorous acid, 300 cc. of a 1 per cent. solution copper sulphate. "All the animals which died died of trypanosomiasis and not as the result of the injections." The minimum toxic dose was not definitely ascertained in any case. "Except in cases injected with the solution of copper sulphate, the effects of which are open to doubt, in no case did we discover any drug with an inhibitory action on trypanosomes."

DELANOË (P.). **Contribution à l'étude du pouvoir pathogène du Trypanosome de Mazagan.** [Pathogenicity of the Mazagan Trypanosome.]—*Bull. Soc. Path. Exot.* 1917. June. Vol. 10. No. 6. pp. 501–512.

In this memoir the author discusses the susceptibility of the various laboratory animals to subcutaneous or intraperitoneal inoculation of virus obtained from the naturally infected horse.

Rabbit.—All rabbits inoculated proved susceptible and the disease ran a more or less chronic course. Death occurred in from 2 to 11 months. The trypanosomes could be demonstrated only at irregular intervals in the peripheral blood, and generally they were few in number. Auto-agglutination of the red blood corpuscles is very distinct and may exist before the trypanosomes appear in the blood.

Severe external lesions appear commencing from 20 to 25 days after inoculation. These first take the form of marked swellings of the conjunctival and nasal mucous membranes together with the formation of crusty muco-purulent discharges on these places. No keratitis, however, appears. The ears become tumefied and hairless and filled with dried-up scaly crusts. Hairless, crusty, symmetrically-placed patches appear on the dorso-lumbar region. Lesions of the genital organs are also distinct, the sheath and the vulva becoming swollen, dry, wrinkled, and crusty in appearance. These lesions become progressively intense during the course of the disease, but the appetite remains normal throughout.

On post-mortem examination no swelling of the spleen is observable; the liver, however, is congested and enlarged, and often attacked with fatty degeneration. In one case the heart was found affected with very advanced fatty degeneration.

Guinea-pig.—A small number of guinea-pigs, infected with the trypanosome after a series of passages through various experimental animals, all proved susceptible and death occurred in from 36 days up to 4 months after inoculation. The trypanosomes could be found at certain periods only in the peripheral blood but when present they were nearly always very numerous. The trypanosomes disappeared abruptly from the blood during the crises. The external lesions were less marked than in the case of the rabbit. The most marked lesions consisted in an intense oedema along the inguinal and external genital regions.

Dog.—This animal is very susceptible contracting a sub-acute infection. The period of incubation was about eight days, and death, which occurred in all cases, took place in from two to four months after inoculation. When present in the blood the trypanosomes are numerous, but they may disappear abruptly from time to time. Auto-agglutination of the corpuscles is often very pronounced and may appear before the trypanosomes in the peripheral blood. The trypanosomes also become agglutinated, forming relatively large clumps.

One dog out of three showed a double keratitis, but no swelling of the eyelids or conjunctiva, and this animal became affected also with multiple abrasions on the fore quarters. The other dogs showed no such lesions. In all cases the animals became affected with a gradually progressive loss of condition until they finally became extremely emaciated, affected with partial paralysis of the hind quarters and respiratory distress.

On post-mortem examination there is distinct swelling of the spleen, and swelling and degeneration of the liver.

White mouse.—This animal is invariably susceptible, but, according to the virulence of the trypanosome, it may show two distinct types of infection; that is, after a period of incubation there may be a continuous and progressive multiplication of the trypanosomes in the blood up to the time of death, or, on the other hand, the disease may run a more prolonged course accompanied by crises or recurrent appearance and disappearance of trypanosomes in the blood. The first type of infection was set up after inoculation with the primary virus obtained from the horse and also in successive passages through mice; the second type was observed after passing the virus beforehand through the dog and rabbit. The period of incubation thus varied from 2 up to 9 days, and the course of the disease was from 6 to 36 days, death taking place after the shortest interval when the trypanosome had been passed through a series of five mice. Auto-agglutination was not very marked. On post-mortem examination the spleen showed marked enlargement.

White rat.—The period of incubation was about 5 days and death occurred in from 18 to 23 days after inoculation from a naturally infected horse, but after three passages it occurred in 5 days. The infection is thus acute in this animal. Very marked swelling of the spleen and congestion and fatty degeneration of the liver is observable in the dead animals.

Alexandria rat.—The infection may be acute or chronic. After infection with virus from a white rat death took place on the 6th day with extremely numerous trypanosomes in the blood and enlargement of the spleen. On the other hand a rat inoculated with virus from a gerbil after passage through a long series of other animals showed a very typical chronic infection, with trypanosomes rarely present in the blood and subsequent recovery.

Gerbil.—This animal is very susceptible, the period of incubation being only from 2 to 3 days. The trypanosomes are very numerous on the 4th day, and then show distinct agglutination. Auto-agglutination of the corpuscles, however, is not observable. One female gerbil gave birth, after inoculation, to seven young, which remained healthy. The mother which in the meantime showed distinct lesions about the nostrils was eaten up after death by her grown-up progeny, and two of these became subsequently infected with trypanosomiasis. Infection by ingestion of an infected dead animal was also shown in another experiment; the period of incubation in this case lasted from 8 to 11 days.

Inoculation of large quantities of virus into fowls and geese gave negative results.

DELANOË (P.). **De l'existence à Mazagan et dans le Cercle des Doukkala (Maroc Occidental) de *Trypanosoma Lewisi* Kent et de *Trypanosoma Duttoni* Thiroux.** [The Presence of *T. lewisi* and *T. duttoni* in Western Morocco.]—*Bull. Soc. Path. Exot.* 1917. June. Vol. 10. No. 6. pp. 456–458.

T. lewisi was very commonly found by the author in rats (*Mus alexandrinus* Geoffroy) caught at Mazagan and in various outposts in the Doukkala district. In certain places almost all the rats were infected. No trypanosomes were, however, found in the gerbils which are very common in this region. *T. lewisi* was, on the other hand, shown to be infective for these animals. Two gerbils thus inoculated intraperitoneally with infected rat blood developed in one case an infection for a short period confined to the peritoneal cavity, and in the other case the trypanosomes became generalised but here also the infection was mostly intraperitoneal and lasted only fourteen days.

T. duttoni is much less common at Mazagan than *T. lewisi* Out of 43 grey mice (*Mus musculus spretus* Lataste, 1883) one only was found infected. In smears stained by the Pappenheim method the trypanosome showed a thin lightly coloured undulating membrane, a blue cytoplasm without chromatinic granules, a rose-coloured nucleus and flagellum, and a deep violet blepharoplast. The dimensions were, total length 35·4μ, free flagellum 6·3μ, posterior extremity to blepharoplast 6·5μ, blepharoplast to nucleus 8·3μ, length of nucleus 4·3μ. The trypanosome was easily maintained by passage through grey mice.

NOVY (F. G.), DEKRUIF (P. H.) & NOVY (R. L.). **Anaphylatoxin and Anaphylaxis. I. Trypanosome Anaphylatoxin.**—*Jl. Infect. Dis.* 1917. May. Vol. 20. No. 5. pp. 499–535. With 1 fig., 18 tables & 2 charts.

"In the course of experimental work on immunity against the trypanosomes of surra and nagana it was found that severe toxic effects with marked hypothermia often followed the injection of autolyzed suspensions of the organisms. When such injections were repeated the chronic intoxication thus induced usually ended fatally, and while a certain minimal protection could be established in carefully treated animals, it was evident that the poisonous action observed was a bar to the production of a higher degree of immunity. As no advance seemed to be possible without a clear understanding of the nature of this intoxication, the trend of the investigation had to be changed into a new direction. At first the poisonous effects were identified with the 'trypanotoxin' of Laveran, but the similarity to that of the so-called anaphylatoxins was such that it led to a study of trypanosomes in their relation to the production of this poison."

The authors describe experiments dealing with anaphylatoxin-production with the surra, caderas and dourine trypanosomes, and *T. lewisi.* The nagana trypanosome is dealt with in greater detail. The methods employed in obtaining fresh serum aseptically from white rats, which were used most largely for experiment, and from guinea-pigs and rabbits are described.

The following is the authors' own summary of their experiments :—

"Anaphylatoxin was produced by 5 different trypanosomes, including the nonpathogenic *T. lewisi.*

"It is made not only by the living cells, but also by the dead, more or less autolyzed, cells, and even by such when heated to 60° C.

"The same mass of trypanosomes can be used repeatedly to toxify different lots of serum without apparently any limit to their inducing power. This serial production in one experiment extending over 8 days, was carried through 20 tests with no indication that the organisms were weaker than at the beginning.

"Rat serum is preferable to guinea-pig serum since it yields a poison which may be 12 or more times as active as that obtained with the latter ; the respective lethal doses being 0·25 cc. of the former and 3 of the latter.

"The speed of poison-production under favorable conditions is very rapid and quickly reaches a maximum, the poison then persisting for a long time. Thus, infected defibrinated rat blood or serum, when incubated for 1 or 2 minutes, may become fatally toxic. With an incubation of about 15 minutes, it is possible to produce a toxic serum such that 0·25 cc. will cause acute anaphylactic death.

"Sera inactivated at 56° C. or 60° C. for half an hour apparently can be toxified.

"The anaphylatoxin was found to persist at 37° C. for more than 4 hours ; at about 0° C. it may persist for an indefinite time. Thus, a surra serum was still toxic after icing for 171 days ; a nagana serum was likewise active for 35 days. Attempts at detoxifying by addition of normal serum, bile, or cholesterin resulted negatively.

"Toxic sera can induce toxicity in normal sera, the mixtures representing a high dilution of the former. This result is not due to the action of a ferment, but to minute amounts of trypanosomes still present in the inciting serum ; or, in the case of very prolonged incubation, to the production of autoanaphylatoxin.

"A comparison of the effects of different centrifugation-rates on chilled, rapidly defibrinated blood shows that sera obtained at slow speed readily become toxic ; the sera secured at a very high speed do not.

"Transfusion experiments indicate the possible presence of anaphylatoxin in heavily infected rats. The formation of this poison in corpore may lead to sudden deaths or to chronic intoxication or cachexia.

"The injection of normal rat serum into infected guinea-pigs does not result in the in-vivo production of poison ; any effect observed is due to the primary toxicity or autoanaphylatoxin of such injected serum.

"The toxicity of trypanosomal sera, when tested at regular intervals, appears to show more or less oscillation. Similar variations are met with in tests with anaphylatoxins produced by other agents, and even in normal sera. They are not due to changes in the amount of poison, but to varying resistance of the test animals.

"The injection of large amounts of washed trypanosomes into guinea-pigs may result in the production of anaphylatoxin in corpore. The effects are not due directly to the organisms, but to the disturbance in the colloidal state of plasma constituents, caused by the alien material.

"The 'trypanotoxins' are therefore disturbers of equilibrium; the result is a poison-production in vivo as well as in vitro. The mode of action of endotoxins in general will be found to be of the same nature.

"The participation of a ferment in this reaction is contra indicated by the speed of production, the rapid attainment of maximal level, the behavior of inactivated sera, and by the results of centrifugation.

"The syndrome of symptoms and autopsy findings consequent on the injection of the trypanosome anaphylatoxin are those of the intoxication of true anaphylaxis. The two poisonings are to be considered as identical."

MARTY (L.). i. **Agglutination et désagglutination des globules rouges dans la trypanosomiase.** [Agglutination and Disagglutination of the Red Blood Corpuscles in Trypanosomiasis.]—*Bull. Soc. Path. Exot.* 1917. May. Vol. 10. No. 5. pp. 392–398.

ii. **De la Pseudo-Agglutination des globules rouges dans quelques affections à parasites sanguicoles.** [Pseudo-Agglutination of the Red Blood Corpuscles in some Diseases due to Blood Parasites.] *Ibid.* June. No. 6. pp. 484–486.

These papers refer presumably to phenomena which have been observed only in the case of human diseases; an extract is here given as the changes described may prove of interest for a comparative study in similar chronic blood affections of animals.

i. If an average-sized drop of normal human blood is placed between slide and cover glass the red corpuscles are observed to become formed into rouleaux from 10 to 50μ in length, in which the corpuscles are apparently held together side by side by two forces acting in inverse directions. These forces, however. prevent clumping of the corpuscles. When regarded by means of the naked eye the preparation presents at places a very finely granular appearance and shows a pale colour except at its border, where on contact with the air the blood has coagulated, forming a continuous haemo-lute preventing a too rapid evaporation.

If one looks through a preparation of trypanosome-affected blood one finds that it quickly takes on a granular appearance throughout; the granules are very much larger, and the preparation, instead of being pale, is of a smoky red colour. Between this distinct appearance of macroscopical agglutination and that of normal blood various degress of agglutination can be observed. In doubtful cases it is necessary to use a No. 7 objective or an oil immersion lens.

If after 5 or 10 minutes one exerts a moderately strong pressure by means of a glass rod or the finger on the preparations of normal and trypanosome blood one finds that the local and very fine granulation in the normal blood disappears and never shows itself again. In the case of the other preparation it re-appears and if the operation is repeated after 15 minutes the same phenomenon occurs; after half-an-hour the granulation becomes changed presenting a reddish sandy-like appearance which persists for several hours.

As the result of the clumping in the trypanosome blood a deeper colour bordering on mahogany is noticed; also, the agglutinated corpuscles withstand crenation and fragmentation into the so-called globulids longer than ordinary red corpuscles.

If one examines the preparation of normal blood under the microscope the red corpuscles at the periphery are formed up close together, forming a zone of corpuscles which soon commence to undergo successively crenation and haemolysis. The haemo-lute protects the preparation fairly well from contact with the air, but its impermeability being only relative all the red corpuscles in the preparation soon become crenated; they then disappear in a structureless deliquium which becomes invaded with air bubbles when the serum evaporates. From time to time corpuscles are seen capable of withstanding crenation longer and split into two or three elements of unequal size (globulids) which disappear last of all in the deliquium.

In a preparation of trypanosome blood one notices that the red corpuscles at the periphery, instead of undergoing crenation, form up into several layers somewhat resembling the superficial strata of the epidermis. The corpuscles in this stratum remain a long time intact and even show the appearance of a piece of mahogany with annular rings, etc. The haemo-lute is much more of an independent structure than that of normal blood; from the deeper surface of the stratum there are seen some prolongations which remind one of the intrapapillary prolongations of the skin. If an air bubble strays into the stratum it immediately becomes surrounded by the corpuscles which form an onion-like mass around it. Later, when evaporation of the serum has progressed to a certain extent the covering stratum loses its continuity and breaks up into pliable columns floating in the lemon-coloured serum. The deeper masses glide smoothly in between obstacles without becoming broken up until they reach the central parts of the preparation. This resistance to disagglutination is characteristic of perfectly agglutinating masses. Behind this covering stratum are formed smaller clumps which diminish in size and number as one approaches the centre of the preparation.

In the preparations submitted to pressure as above described one notices that in the case of normal blood the longer rouleaux are split up into two or three small columns. The first pressure in the other case has the effect of dividing the corpuscles into two classes, viz., those which contribute to the formation of clumps, and those which having insufficient agglutinating power are broken up into globulids. In the case of the clumps after the first pressure the heaped up rouleaux are broken up but as soon as the pressure ceases the various pieces become bound up together to form larger clumps with irregular margins surrounded by globulids. The central part of the clump is of a deep yellow, sometimes mahogany, colour; the thinner periphery is of a straw-coloured yellow. The haemo-lute is also broken up but forms up again into a less regular and incontinuous stratum.

The same phenomenon is repeated when pressure is exerted again a quarter or half an hour later. The evaporation of the serum is accelerated and the clumps take on new characters. The red corpuscles in order to escape desiccation become bound up more closely together and their contours become very irregular, the upper layers of corpuscles being in continuous active movement.

The third pressure performed half-an-hour later accentuates the binding together of the clumps. There are then formed within them clear spaces which appear in the form of crescents at the borders or in the form of clear alveoli about the size of a corpuscle in the centre of a clump. The spaces may at times take on a copper colour.

A little later the vacuolisation of the clump is still more pronounced and it resembles an organ affected with fatty degeneration.

Towards the end, the massing of the corpuscles into clumps disappears; the attractive force becomes *nil*, and the clump spreads itself out. It is then seen under the form of sulphur-yellow flakes striated by the stellate outlines of the capsules of the red corpuscles. Last of all the striation or pattern work disappears and the clump undergoes a granular degeneration.

In order to study the phenomenon of agglutination-disagglutination it is better not to use a vaseline lute as this prevents the formation of the covering stratum. The most suitable drop of blood is that which only covers from two-thirds to three-quarters of the cover glass after slight pressure. Drops which cover the whole cover glass or only one-quarter to one-half are of no use for the study. After a first injection with atoxyl or, even better, following the injection of the second dose, the agglutination-disagglutination of the red corpuscles is increased to a marked extent. The phenomenon was not observed in other human diseases such as syphilis, yaws, malaria, and haemoglobinuric biliary fever.

ii. In other human affections due to blood parasites (spirochaetoses, malaria, and, to a lesser degree, in filariasis and in intestinal amoebiasis) an analogous phenomenon, which is less distinct and is hence called pseudo-agglutination, is observed in connection with the red corpuscles. In a very thin preparation this pseudo-agglutination is not seen. In a thick preparation the corpuscles form flakes of a laked appearance, more or less independent one from another. These may tend to cause confusion with the agglutination observed in trypanosomiasis. Preparations must be carefully made. An average sized drop of blood is placed on a slide and covered gently with a cover glass with the aid of a pair of forceps; a gentle and even pressure is exerted on the cover glass so as to spread the drop without crushing it.

Examined with the naked-eye the preparation shows no peculiarity. The rouleaux are slightly massed but there is no clumping by superposition. The alignment of the elements in the rouleaux is not perfect; in the neighbourhood of the haemo-lute the rouleaux are a little deeper in colour than normal, tend to collect together, and take on a varnished appearance. The same appearance is shown in slight trypanosome affections and in those which can be considered cured after a long treatment. After a shortly applied compression the rouleaux are broken up and do not form up again into mahogany-coloured spots. In the haemo-lute there are clusters of closely packed corpuscles but there is no stratum formation as in typical trypanosomiasis blood. Crenation of the corpuscles is more delayed than in the case of normal blood. The globulids are concomitants of the mahogany-coloured spots, that is to say, they are few and scattered in slight trypanosomiasis, but do not exist in cases of pseudo-agglutination.

The author attempted to intensify the agglutinating power of red corpuscles in trypanosomiasis so as to show up the mahogany-coloured spots more distinctly in the lighter forms of the disease. In a good preparation the blood covers about three-quarters of the cover glass and around the haemo-lute there remains an empty space between the slide and cover glass. By means of a platinum needle bent at right angles a drop of 1 in 1,000 potassium carbonate is placed on the edge of the cover glass. This drop quickly comes in contact with the haemo-lute by means of capillary attraction. The haemo-lute in trypanosomiasis withstands disintegration very well while in the case of pseudo-agglutination it is almost immediately disorganised and carried away with the liquid currents. The lemon-yellow clumps of uncertain significance in slight trypanosomiasis become more distinct and of a mahogany shade. The pseudo-clumps do not resist; in the case of syphilis or acute malaria there may form in the centre of the preparation outside the limits of the currents small clumps of from five to six corpuscles with irregular ragged borders of a deep colour. A slight pressure exerted on the centre of the cover glass causes them to disintegrate and set free the crenated corpuscles which are carried away by the currents and prevented from re-agglutinating.

The author concludes that an examination for the phenomenon of agglutination-disagglutination with its accompanying globulids enables one to establish a diagnosis in the majority of trypanosomiases. In the milder forms recourse must be taken to a test injection with atoxyl or, much more simply, to impregnation with 1 in 1,000 solution of potassium carbonate; this potassium salt, by increasing the agglutinating power of the red corpuscles, enables one to differentiate between a very slight trypanosomiasis agglutination and a pseudo-agglutination due to some other infestation.

(e) MISCELLANEOUS.

SANLORENZO (F.). **Coccidiose intestinale "dysenterie rouge" du boeuf en Piémont.** [Bovine Intestinal Coccidiosis or "Red Dysentery" in Piedmont, Northern Italy.]—*Bull. Soc. Path. Exot.* 1917. June. Vol. 10. No. 6. pp. 446–447.

The above disease, which has been described by numerous authors in several countries, has not hitherto been recorded in Italy. Three cases of dysentery in cattle in the neighbourhood of Alessandria were found to have been caused by *Coccidium bovis* or *Eimeria zurni*, which was present in very large numbers in the faeces. The author believes that the disease is more widespread in Italy than is generally believed. Daily doses of 15 grains of thymol effected a cure in the author's cases.

SERGENT (Etienne). **Sur des formes sans pigment ou à pigment très fin apparues chez le *Proteosoma* (*Plasmodium relictum* Grassi et Feletti) au cours de passages par canaris.** [Non-Pigmented Forms or Forms with Very Fine Pigment appearing in Proteosoma in the Course of Passage through Canaries.]—*Bull. Soc. Path. Exot.* 1917. June. Vol. 10. No. 6. pp. 448–450. With 2 figs.

In the course of experiments on the immunity of birds towards Proteosoma peculiar forms were found in the blood corpuscles in rare instances (3 out of 700 canaries). The intraperitoneal injection of the infected blood from these cases into three other canaries reproduced the same forms. The parasites without pigment were young rounded forms capable of attaining a diameter equal to a third of that of the corpuscles. (In ordinary Proteosoma a large granule of black pigment appears always as soon as the parasite becomes visible within the corpuscle.) The parasites containing very fine pigment were larger than the preceding, generally placed alongside the nucleus, which sometimes was not displaced; the pigment was appreciably finer than that of normal Proteosoma and this difference was especially seen when examined in the fresh state. Simultaneously with these two forms there were seen the ordinary forms of Proteosoma with a large amount of pigment but the forms without pigment or with very fine pigment were always more numerous than the classical forms.

It thus appears that the author had under observation certain forms of Proteosoma capable of being reproduced by inoculation in the bird and he argues that by analogy this observation lends support to LAVERAN's theory with regard to the unicity of the parasite of human malaria.

SERGENT (Etienne) & HEMPL (H.). **Sur l'immunité dans le paludism des oiseaux (*Proteosoma* vel *Plasmodium relictum* Grassi et Feletti).** [Immunity in Bird Malaria.]—*Bull. Soc. Path. Exot.* 1917. July. Vol. 10. No. 7. pp. 550–552. With 1 chart.

In bird malaria due to Proteosoma there is after the commencing acute infection a period of relative immunity. A test inoculation —intraperitoneal injection of blood which is certainly infective for control birds—does not cause the parasites to appear in the peripheral blood. Sometimes only a short and benign relapse sets in, with at times a short incubation period (one or two days). This accounts for the so-called acclimatisation of the old inhabitants of a fever stricken country. This immunity is acquired from the 6th day after the commencement of blood infection.

In the experiments described by the authors five canaries infected at least 2½ years previously showed, in the case of four, that the relative immunity had lasted over this period. The fifth showed after the test inoculation a very marked infection.

LAVERAN, in discussing this paper, states that the disease of birds studied by the authors has nothing in common with human malaria and that it is unfortunate that it should be designated under the name of bird malaria.

YAKIMOFF (W. L.) & SCHOKHOR (N. J.). **Leucocytogrégarine des chiens au Turkestan russe.** [Leucocytogregarine of Dogs in Russian Turkestan.]—*Bull. Soc. Path. Exot.* 1917. Apr. Vol. 10. No. 4. pp. 281–282.

The parasite described by the authors was identical with *Leucocytogregarina canis* James, 1905, and was found in 15 out of 151 dogs examined in various districts. The organisms were found in the peripheral blood, parenchymatous organs, and bone marrow. In the blood they were always intra-cellular, and in the organs almost always free-lying. They were of an elongated oval shape and slightly kidney-shaped. When stained each parasite showed a clear blue protoplasm containing sometimes a variable number of small granules, with a red-stained compact and finely granular nucleus situated sometimes towards one end. The membrane was colourless. A periplast was distinguishable.

Parasites belonging to the same species have been described by various authors in India, in the Malay States, French Indo-China, Lake Tanganyika, French Congo, Tunis, Baghdad, Italy, Algeria, and Corsica. Different species have been found in the blood of dogs in Upper Senegal and Nigeria, and Eritrea.

LEGER (M.) & MOUZELS (P.). **Hémogrégarine intraleucocytaire d'un saurien,** *Tupinambis nigropunctatus.* [A Haemogregarine found in the Leucocytes of a Lizard, *T. n.*]—*Bull. Soc. Path. Exot.* 1917. Apr. Vol. 10. No. 4. pp. 283–284.

The parasite described by the authors was found in the blood of one of the large richly coloured lizards found in Cayenne gardens. Its chief peculiarity was that it was found only within the leucocytes—the large and small mononuclears. The organism was enclosed within a very thin-walled cyst 9 to 11μ long by 5 to 7μ broad; it contained a nucleus of variable shape and a homogeneous protoplasm containing brightly staining chromatinic bodies disseminated throughout it. The haematozoon at first sight appeared oval but on closer examination was found to be 16 to 18μ long and folded back on itself, the tapering tail being bent back on the body.

Haemogregarines within the leucocytes of lizards have already been described by LAVERAN and others, but in those cases the majority of the parasites were found within the red corpuscles and other places. The authors propose the name *Haemogregarina weinbergi* for the parasite described by them.

BLANC (Georges). **Sur un cas de toxoplasmose canine observé en Tunisie.** [A Case of Canine Toxoplasmosis observed in Tunis.]—*Bull. Soc. Path. Exot.* 1917. May. Vol. 10. No. 5. pp. 377–378.

In this short note the author describes the first case of canine toxoplasmosis recorded in Tunis. The disease occurred in a dog that had been inoculated with crushed up material from the nymphae of ticks fed on a dog affected with kala azar. The dog died a month afterwards without in the meantime showing any symptoms, and on post-mortem examination toxoplasms were found in its organs but no Leishmania. Another dog treated in the same way became emaciated and developed conjunctivitis and opacity of both corneae, but no Leishmania or toxoplasms were discoverable on post-mortem examination. A fact of importance was that the dog affected with toxoplasms was kept in the same building as a number of gondi. Naturally occurring toxoplasmosis had been observed regularly for several years in autumn and in winter among these gondi, and the infection may possibly have been transmitted from them by means of larvae of ticks to the dog.

YAKIMOFF (W. L.). **Trichomonas de l'intestin de la sangsue du Turkestan** (*Limnatis turkestanica.*). [Trichomonas in the Intestine of the Turkestan Leech.]—*Bull. Soc. Path. Exot.* 1917. Apr. Vol. 10. No. 4. pp. 293–294.

Trichomonas have been observed in man and in several warm-blooded animals as well as in some cold-blooded animals. BRUMPT found some of these organisms in leeches. In a smear from the intestinal contents of a species of leech found in the drains of Taschkente the author found the vegetative forms— oval, pear-shaped, and rounded in appearance The dimensions of the organism, nucleus, and its three flagella are given. Certain peculiar bodies believed to be Trichomonas cysts were also seen.

NOELLER (W.). **Blut- und Insektenflagellatenzüchtung auf Platten.** [The Plate Cultivation of Blood and Insect Flagellates.]—*Arch. f. Schiffs- u. Trop.-Hyg.* 1917. Feb. & Mar. Vol. 21. Nos. 4 & 5. pp. 53–94. With 3 text figs. & 1 coloured plate comprising 6 figs.

The medium used by Nöller for plate cultures was a slight modification of the ordinary N.N.N. medium and was made up as follows :— Agar 10, glucose 10, slightly alkaline horseflesh broth 1,000. This is distributed in tubes each containing 12 to 18 c.c. and sterilised by placing in a steamer on two successive occasions. This medium is melted in boiling water and poured from the tube into small glass vessels and thoroughly mixed with an equal quantity of sterile defibrinated horse blood. The mixture is then quickly poured into a sterile Petri dish, the lower dish being about 9 to 10 cm. in diameter by at least 2 cm. in height. The dishes are then immediately placed in an ice chest for the medium to set.

When inoculated the Petri dishes are inverted in the ordinary way and to prevent contamination the condensation liquid is caught in a 2 to 3 per cent. solution of sublimate which forms a layer 1 to 2 mm. in thickness in the cover. At room temperature the sublimate is renewed every two to three days, and at a higher temperature (28° to 33° C) daily, to compensate for evaporation.

The plates are inoculated with a small platinum loop. Impure seed material is diluted in broth, a drop placed on the middle of the plate, and spread evenly over its surface by means of a glass bulb. Pure cultures are transplanted by means of a soft sterile moistened camel hair brush. For serological tests young thick cultures are used in which degeneration forms have not appeared and material is lifted up carefully by means of a platinum loop in order to avoid admixture with any of the culture medium.

Seed material for the cultivation of insect flagellates is obtained by first examining aseptically small pieces of the insect intestine in sterile salt solution under a low power of the microscope in order to determine the presence of flagellates. The small pieces are repeatedly washed in sterile broth to get rid of most of the contaminating bacteria. A single small piece is then placed in a drop of broth on a sterile glass slide and covered with a sterile cover glass, which is moved to and fro in order to distribute the flagellates. By means of a small sterile syringe containing 1 to 2 c.c. of broth one then places a drop of broth at one end of the cover glass and sucks up the liquid at the other end. The contents of the syringe are well mixed and the process repeated several times until most of the flagellates have been drawn up into the syringe. A drop of the mixture is then spread over a plate and the platinum loop used to inoculate two or three more plates successively.

In order to separate impure cultures of flagellates from bacteria one makes use of the fact that the flagellates usually cling together in rosette-like clumps containing, as a rule, very small numbers of bacteria. The large cultivable flagellates also adhere very firmly to a glass slide. The material is thus placed in a large drop of sterile broth on a sterile glass slide and allowed to stand for 5 to 10 minutes. A small rosette-like clump then adheres so firmly to the slide that it can be washed with salt solution or broth several times without becoming detached. The clumps are then scraped off with a platinum loop and drawn up into a syringe containing about ½ c.c. sterile broth, shaken, and a drop used for inoculating one or several plates successively.

A second method used for the separation of flagellates, such as the sheep-louse Crithidia, which does not possess the same adhesive properties, consists in placing the impure culture in a drop of broth and carefully sucking up the large rosette-like clumps into a fine pipette. These are then mixed with another drop of broth, gently shaken, and again sucked up ; the process is repeated until the clumps have been washed five to ten times.

Leptomonas fasciculata Novy, MacNeal, and Torrey, 1907.—This gnat Leptomonas, first described improperly by LÉGER, is important as it was the first insect flagellate cultivated (NOVY and collaborators, 1906) on plates and on account of the ease with which it is cultivated. Pure cultures have been kept alive by MESNIL even on ordinary agar. The author himself cultivated the parasite from the hind gut of two Culex females according to the method above described. The plates were kept in the dark in an incubator at from 22° to 26° C. In three days small dew-like colonies ·25 to ·5 mm. in diameter could be seen between the numerous bacterial colonies. Two days later the colonies reached from 2 to 3 mm. in diameter, were rounded, flat, and transparent. Later these colonies spread over the plate forming a dense mass of flagellates of a greyish-white colour. If this material is now transplanted on fresh plates discrete colonies are visible in one or two days and in from 6 to 10 days the growth spreads over the plate as a thick film. In plates from one to three days old the parasites show distinct nuclei and round compact karyosomes in process of division. In older cultures the flagellates are thinner and show a very indistinct nucleus with a minute karyosome.

Leptomonas ctenocephali Fantham. (= *Leptomonas pseudoleishmania* Brumpt).—Flea leptomonads are of great interest inasmuch as they were recognised by SANGIORGI and BASILE as stages in the development of the Mediterranean child Leishmania. The dog flea was thus supposed to transmit Leishmania from dog to man and from dog to dog. The author, however, in 1912, showed that this flagellate is very common in dog fleas in Leishmania-free districts (Berlin). DA SILVA, in Morocco, obtained negative results in transmission experiments with fleas that had fed on infected children. LAVERAN and his collaborators and FANTHAM and PORTER later claimed to have infected mammals with insect leptomonads; according to Nöller these writers failed to reproduce the pathological picture presented by a Leishmania infection and to demonstrate the viability of the Leishmania-like bodies said to have been found in the organs of the young animals supposed to have become infected.

WENYON (1913) first obtained a pure Leptomonas culture from the human flea and the organisms cultivated presented a striking resemblance to Leishmania. LAVERAN and FRANCHINI (1915) also obtained pure cultures of leptomonads from the mouse flea (*Ctenopsylla musculi*).

Nöller successfully cultivated leptomonads from the dog flea in the condensation water of glucose-horse-blood-agar tubes in 1914. The tubes were kept at a temperature of from 18° to 21° C.; development was very slow: only after from six weeks to three months did the flagellates produce turbidity in the condensation water. The cultures, however, showed marked viability inasmuch as motile flagellates were observed in the sealed tubes nearly two years afterwards.

In plate cultures growth was very slow at from 23°–25° C., but at 29° C. just visible colonies were observed in from 11 to 12 days. Pure sub-cultures kept at 28° C. show in about 14 days small round colonies up to ·5 mm. in diameter, which later coalesce but show scarcely any tendency to spread beyond the inoculated area. The growth on plates is thus much slower than that of *Leishmania donovani*.

A number of mice were inoculated intravenously with ½ c.c. of a milky emulsion of Leptomonas culture. A few died during the following month with enlarged spleens due to infection with *B. coli*. Nine weeks after inoculation the remaining mice were killed and cultures were made from the spleen and liver, with entirely negative results.

Leishmania donovani Laveran and Mesnil, 1903.—The Hamburg strain of *L. donovani* sown on the author's plates showed on keeping in the dark at 22° to 25° C. after 16 days a 4 to 5 mm. broad greyish-white film along the inoculation mark. On sub-culture on plates growth was seen in 7 to 10 days spreading from 1 to 2 mm. beyond the line of inoculation and later (in about 35 days) short stumpy outgrowths 1 to 3 mm. long by 0·3 to 0·5 mm. broad could be observed. A loopful spread evenly over a plate shows a uniformly thick film in from two to three weeks. Growth is apparently better in tubes of glucose-horse-blood-agar than in N.N.N. horse-blood-agar.

Crithidia melophagia Flu, 1908. (= *Crithidia melophagi* Swingle).—The sheep louse Crithidia were first cultivated by Wenyon, 1912, in the condensation water of N.N.N. rabbit-blood-agar. The author himself succeeded in 1916 in cultivating these flagellates from the anterior portion of the mid-gut of a sheep louse on glucose-horse-blood-agar tubes. Growth took place very slowly and between the colonies there appeared minute colonies of a coccobacillus similar to *Rickettsia prowazeki* found in the clothes louse and believed to be the cause of typhus in man. The name *Rickettsia melophagi* is given to this small organism which is apparently always found in large numbers in the intestinal tract of the sheep louse. It shows bi-polar staining when stained with Giemsa. In mixed cultures of this small organism and the Crithidia growth takes place very slowly in both cases; at 23° to 25° C. the Crithidia developed rather more quickly than the Rickettsia, but at 28° to 29° C. the Rickettsia grew slightly more quickly than the Crithidia. Macroscopic clumps of the Crithidia were found in the condensation water after two months. These were separated by the pipette method described above and sown on to plates kept at 29° C.; in 21 days small flat round transparent colonies 1 to 1·5 mm. in diameter could be seen between the just visible protruding Rickettsia colonies. Pure cultures were subsequently obtained. The sheep louse Crithidia undoubtedly resemble those blood parasites that are cultivated with difficulty. The best medium consists of glucose-horse-blood-agar in tubes.

The morphology of the organisms in culture is similar to that in the intestine of the sheep louse. The tendency to clump formation on the media is very apparent. The aspect of the very small culture forms and the difficulty with which they are cultivated precludes their identity with the cultural forms of the non-pathogenic cattle trypanosome *T. theileri*. If the theory of WOODCOCK and BEHN that the sheep louse Crithidia in England and Germany are stages in the development of sheep trypanosomes is correct then the latter organisms must differ from those of the *theileri* group. The author himself has had no opportunities of examining sheep trypanosomes.

Trypanosoma theileri Laveran, 1902.—The author demonstrated the identity of the flagellates cultivated from the gadfly *Tabanus glaucopis* and the ubiquitous cattle trypanosome in 1916 [see this *Bulletin*, Vol. 5, No. 1, p. 15].

The maintenance in the laboratory in a pure state of the forms then isolated led the author to devise his method of plate cultures. By this means pure cultures were obtained after five platings. The growth of the organism on plates is somewhat typical. In from five to seven days at 22° to 25° C. visible, rounded, dew-like transparent colonies ·5 mm. broad are seen. The colonies are later seen to throw out fine thread-like processes which again divide giving an appearance resembling that of a bark beetle. On moist plates the radiating processes grow two or more millimeters daily so that in a week's time, where there are numerous colonies, the plate seems covered with very fine threads. These threads are at first scarcely visible but later they become thicker, greyish-white in colour, and are clearly visible against the dark-red background.

During the first five to seven days long thin flagellated organisms are seen between which numerous dividing forms are found. The viability of the trypanosomes on plates is rather short. A few living forms were found in 47 day old plates kept at 22° C. Generally after from 7 to 10 days degeneration forms become very apparent, without flagella or undulating membranes and with numerous nuclei scattered throughout a single protoplasmic body.

Trypanosoma syrnii Mayer, 1911. (*Halteridium syrnii* Mayer, 1911).

The blood parasite from the wood screech owl, named as a Halteridium by its discoverer, grows easily in sub-cultures on plates. Stroke preparations kept at 22° to 25° C. show within seven days a number of parallel outgrowths 1 to 3 mm. broad and distant about 1 to 3 mm. from each other; these may attain a length of from 5 to 12 mm. and in 14 day old plates they may attain a length of up to 2·5 cm. The colonies are thus easily distinguishable macroscopically from those of the slowly growing cattle trypanosome from the gadfly. The colonies are of a greyish-white colour.

Trypanosoma rotatorium Mayer, 1843.—The commonly occurring and easily cultivable frog trypanosome was the object of a special study. The seed material was obtained from a well-nourished medium-sized water-frog showing a few rare trypanosomes in its blood. Blood was drawn from the abdominal vein and mixed with an equal quantity of citrate broth and sown on to plates kept at 22° to 25° C. In four days minute colonies were seen which in seven days attained a diameter of 1 mm. In from two to three weeks they attained a diameter of 3 to 5 mm., but their margins remained regularly rounded. Stroke sub-cultures showed in 14 days a thick greyish-white film with smooth rounded borders spreading 3 to 5 mm. outside the inoculation track. On very moist plates short stumpy outgrowths from 2 to 3 mm. in length and which easily coalesce may be observed. During the first three weeks the culture shows slender, actively motile forms with homogeneous cytoplasm, but from that time onwards degeneration forms appear to a gradually increasing extent.

A number of experiments detailed by the author showed that it was possible to infect water frogs in most cases with large doses of culture. MENDELEEF-GOLDBERG, on the other hand, obtained only negative results in such experiments, frog serum being stated to be highly trypanolytic. Nöller, however, showed that it was possible to obtain multiplication forms in frogs that had already been infected, death resulting within a fortnight in some cases. The trypanosomes were then numerous in the heart blood and very rich preparations were obtained from the kidneys. Long whip-like trypanosomes and short striped ones as well as phagocyted Leishmania-like bodies could be seen. It is recalled that THIROUX showed that the common trypanosome of the Java sparrow might produce marked pathogenic effects when inoculated in large doses. The grass-frog was found to be more resistent to infection than the water-frog. Inoculation gave negative results in the case of toads and goldfishes although an abortive infection was demonstrated in some of the latter animals.

A number of serological tests were made by the author with the frog trypanosomes grown on plates. The emulsion for the agglutination test was made in the ordinary way by taking up some clean culture in a platinum loop and diluting it with salt solution. A number of trypanosomes were found to be still alive in this solution after three days even when diluted 350 times. Blood was obtained from the frog by severing the hind leg at the stifle joint. The frog could be used for further experiment by tying the skin back over the cut surface again. The agglutination tubes were read off first after two hours and next after from 18 to 24 hours. The tubes were kept at room temperature (17° to 21° C.).

The horse serum used for making culture medium showed distinct agglutination in 1 in 20, and appreciable up to 1 in 80 dilutions. Fresh unheated horse serum was found to be extremely toxic for the trypanosomes. All forms were dead within an hour in undiluted serum. A 1 in 10 dilution was also very toxic and after standing a day careful search revealed extremely few motile forms. Serum heated to 56° C. had lost its toxicity, but agglutination was still appreciable in dilutions of up to 1 in 80.

With fresh guinea-pig serum agglutination was obtained only in dilutions of 1 in 10 up to 1 in 20, but, on the other hand, its toxicity was greater than that of the sera of normal grass-frogs and infected water-frogs. The trypanosomes all became immotile in dilutions of up to 1 in 20, but with weaker dilutions—1 in 160—a few rare trypanosomes were seen alive and these were always the long forms with homogeneous protoplasm. Inactivation caused the toxicity to disappear but the agglutination titer remained as before.

These results are not in keeping with those of M.-Goldberg, whose technique, according to the author, was faulty, in that she used the trypanosomes suspended in the liquid of condensation of the medium. The author showed that even when mixed with the undiluted serum of an infected water-frog complete destruction of the trypanosomes did not take place. A few long forms remained. The same results were obtained with tadpole blood. The serum of infected water-frogs showed distinct agglutination in dilutions of 1 in 40 and appreciable in 1 in 80. Undiluted serum killed off nearly all trypanosomes, but about 1 per cent. remained alive; a dilution of 1 in 10 killed about 90 per cent; a distinct toxicity could be seen in up to 1 in 40 dilutions. Inactivated serum was non-toxic.

The serum of non-infected grass-frogs showed complete agglutination in 1 in 40 and distinct 1 in 80. Undiluted serum killed off almost all trypanosomes but a few remained alive as in the case of the infected water-frog.

It is noted that although the serum of the infected water-frogs showed a certain trypanocidal action the infectivity of the animal need not be diminished; normal human serum shows a high trypanocidal action on the virulent *T. rhodesiense.* The problem of trypanosome infection is extremely complicated. Many trypanosomes are known not to multiply chiefly in the blood but in the lymphatic system and other organs. It is only the pathogenic African trypanosomes and the nearly related organisms that act as pure blood parasites. No specific immunity could be detected in chronically infected water-frogs.

Schizotrypanum cruzi Chagas.—It was not possible to obtain a direct culture on plates from a laboratory infected mouse but growth was easily obtained at 29° C. in the water of condensation of horse-blood-agar tubes. The organisms were seen as Leishmania-like bodies devoid of flagella among which extremely few flagellated forms were seen. Later crithidial forms were found at the periphery of the clumps. Sub-culture on to plates was made from the water of condensation and at 33° C. there was soon seen small rounded colonies which coalesced and covered the inoculation track with a thick film in 10 days. Growth was slower at lower temperatures, and it may thus be said to be moderately slow. On plates one finds Leishmania-like forms and also a large number of typical crithidial forms.

DISEASES DUE TO METAZOAN PARASITES.

Commes (Ch.) & Devanelle (P.). **L'Onchocercose aortique bovine dans le Haut-Sénégal-Niger.** [Bovine Aortic Onchocerciasis in Upper Senegal and Nigeria.]—*Bull. Soc. Path. Exot.* 1917. June. Vol. 10. No. 6. pp. 459–464. With 2 text figs.

In the course of a study of the human filariae of the above regions A. Leger (1912) noted that filarial embryos were also widely distributed in the blood streams of other animals, such as the calf, dog, hyena, and a number of birds.

The authors maintain that the ox is the animal most often affected. In the course of examinations of the left bronchial glands of slaughtered cattle they often cut through glandular-looking bodies from the size of a pea to a cherry containing yellow, caseous, distinctly calcified material. These movable nodules were found to be attached by means of connective tissue to the external coat of the aorta. Swellings of a similar nature were also found in direct contact with the blood vessel or still completely embedded in its external coat. Similar lesions could also be found on incision in the thickness of the wall and some of these on section disclosed simply a sort of transparent coagulated lymph. On the internal surface of the vessel wall there were also to be found cysts of about the size of a lentil filled with greenish-yellow matter. One could also note sometimes under the endothelium wavy channels protruding into the lumen of the vessel and filled with a brownish-yellow transparent clot ; sometimes they were deeper and showed up clearly as greyish tracks against the opal-like whiteness of the endothelial coat.

These lesions were found on the main aorta, on about the first 30 cm. of the posterior aorta, and the first 10 cm. of the anterior aorta. The curvature of the posterior aorta was always the part most extensively affected.

All these lesions contained a nematode worm ; the worms must thus have burrowed through the walls of the arteries adjacent to the heart and finally invade the periarterial connective tissue. For some reason the worm becomes at times encysted at some period in the course of its migration. 151 animals out of 198 systematically examined for these lesions, or 76·3 per cent. were found affected.

The classification of the parasite was undertaken by RAILLIET who showed that it was identical with *Onchocerca armillata* Raill. and Henry, 1909. The parasite was first described by LINGARD (1905) affecting the aortic wall of oxen and buffaloes in India, by TUCK (1907–1908) affecting oxen in the Malay States, and recognised by RAILLIET himself in 1902 in the aorta of a zebu from Sumatra. BERNARD and BAUCHE (1912) also found it in Annamese cattle. It has already been found on the African Continent by MASON, who attributed the aneurisms frequently occurring in Egyptian cattle and buffaloes to this parasite. Certain variations in the nature and position of the lesions have been noted by various authors. RAILLIET states that in his original description of the parasite (1912) the disposition of the genital papillae at the caudal extremity of the male was not accurately described as a number of them escaped his attention. He now states that the number appears to vary considerably in parasites from different regions so that it is impossible to fix a definite papillary formula.

DELANOË (P.). **Au sujet de l'existence dans le Cercle des Doukkala (Maroc Occidental) de la sangsue de cheval, *Limnatis nilotica* Savigny.** [The Horse-Leech in Western Morocco.]—*Bull. Soc. Path. Exot.* 1917. June. Vol. 10. No. 6. pp. 458–459.

The horse leech is frequently found to infect wells in the Doukkala district in Western Morocco, and cases of respiratory distress in the human subject are not infrequently caused by drinking water from these wells. Horses are also very commonly affected in the same way. The author observed cases of pigs dead from asphyxia caused by this leech. The treatment employed by the natives consists in crushing up some onions together with tobacco and cautiously pouring the expressed liquid drop by drop into the nostrils and into the throat. This irritant mixture causes the animal to sneeze and cough violently and thus expel the leeches. The best way of ridding the wells of leeches is to breed eels in them.

MOUCHET (René). **Contribution à l'étude des Myiases.** [A Study of the Myiases.]—*Bull. Soc. Path. Exot.* 1917. June. Vol. 10. No. 6. pp. 467–472. With 1 map.

In the country towards the western shores of Lake Tanganyika in the Belgian Congo the author studied a considerable number of cases of cutaneous myiasis affecting man and various animals. Nearly all the Europeans living in this region become infected with small cutaneous abscesses caused by a muscid larva. Under the name of " kiolo " this is well known to the natives as a parasite frequently infecting dogs. In one village situated at a fairly high altitude all the dogs were infected, small abscesses being found very commonly on the lower parts of their bodies.

On searching the native huts it was found that the rats and mice were almost constantly infected. Whereas, however, in the case of the dog a widespread infestation causes merely a transitory debility a fatal termination is often produced in the mouse and rat, or the abscess formation and gangrene may result, for example, in the loss of a limb. On the other hand, rats and mice caught outside in the open country among the brushwood showed no larvae and it thus appears that only those animals living inside houses become infected.

The parasite appears to be confined to the margins of the lake and can be found even in moderately high altitudes. The mouse and rat appear to be predilection hosts for the larva ; in one village it was noted that the larva disappeared after a number of imported cats had exterminated these rodents. The Katanga Scientific Commission (1910–1912) was of opinion that the fly does not lay its eggs directly on the hosts but in the places where they habitually repose. This may account for the relatively greater incidence of infection in the rat and mouse than in the dog, which spends the greater part of its time outside the hut. Europeans become more readily infected than natives, probably because the fly finds a suitable place for laying its eggs in the bedclothes of the former whereas the native generally sleeps on dry reeds or hard boards.

The adult larva measures from 14 to 18 mm. in length and shows the general characters of muscid larvae. Attempts at cultivating the young larvae proved fruitless but the transformation of the adult larva was easily obtainable. When deposited on dry earth it became a pupa in from 24 to 28 hours and in from 10 to 16 days afterwards the fly emerged. In six series of experiments thus performed five gave rise to flies of the species *Cordylobia anthropophaga* Bl. and in the other experiment the species was *Sarcophaga haemorrhoidalis* Meig. = *nurus* Rdi. These two species of flies are very abundant inside houses.

A series of other muscid larvae have been found capable of causing myiasis in man and other animals in the Belgian Congo. The author himself studied in 1912 at Leopoldville on the head of an ox an extensive sore caused by the larvae of two species, viz., *Chrysomyia megacephala* Fabr., and *Lucilia sericata* Meig.

In 1914 at Tanganyika very serious ulcers involving the legs of goats were attributed to larvae of the species *Chrysomyia bezziana* Vill. =*megacephala* Fabr. Large oestrid larvae from 25 to 30 mm. in length are also frequently found in the nose and nasal sinuses of certain large antelopes, but breeding experiments with the larvae have given no results in these cases.

ROUBAUD (E.). **A propos de la communication de M. Mouchet "Contribution à l'Etude des Myiases."**—*Bull. Soc. Path. Exot.* 1917. June. Vol. 10. No. 6. pp. 472–474.

In this criticism of the preceding article Roubaud states that the myiasis studied by MOUCHET was the ordinary African furunculous myiasis caused by *Cordylobia anthropophaga* Em. Blanchard. The larva was first discovered in Senegal in 1862 by COQUEREL and MONDIÈRE. The author has also shown that the larva of the fly described by DÖNITZ in 1905 under the name *Cordylobia murium*, which gave rise to a severe outbreak of disease among rats in German East Africa, was also identical with the above species. The natural infection of rats with this larva has been studied by DELANOË in the Ivory Coast. The larvae recently hatched out from the eggs may remain on the surface of the soil up to a fortnight at least awaiting the passage of a favourable host. The small larvae, which climb and are motile, then cling on to clothes and afterwards reach the skin. The eggs may also be hatched out directly on clothes, but infection cannot be produced directly in this way.

The second type of fly obtained by MOUCHET viz., *Sarcophaga nurus* Rdi., is not a specific causal agent of myiasis, but has a widespread distribution in various parts of the world. Infection by this larva must thus have been secondary to that of the first-named species.

Myiasis due to *Chrysomyia bezziana* Vill. is a specific myiasis of cattle in tropical Africa [see this *Bulletin*, Vol. 5, No. 1, p. 28].

ROUBAUD (E.). **Histoire d'un élevage de *Glossina morsitans* à l'Institut Pasteur de Paris.** [Breeding of *G. morsitans* at the Pasteur Institute, Paris.]—*Bull. Soc. Path. Exot.* 1917. July. Vol. 10. No. 7. pp. 629–640. With 2 figs. & 3 tables.

The brood of flies described by Roubaud originated from one surviving fertile female *morsitans* and two males brought back by him at the end of 1913 from Senegal. The brood was kept alive in the laboratory for more than three years.

Breeding took place in an incubator with an average temperature of 25° to 27° C. and 50 to 55 per cent. average humidity. A vessel containing water placed in the incubator produced the necessary humidity. Continual change of air was found to be indispensable for normal development. At one period the incubator temperature accidentally exceeded 32° C. and caused a mortality of 50 per cent.

among the pupae and the adults. LLOYD in Rhodesia observed that at 30° C. 49 per cent. of the pupae did not undergo further development. In the Nigerian Soudan the author bred *morsitans* at a temperature of 32° C., but this represented the average daily temperature established according to the maxima and minima.

Cages made of a metallic framework, 14 cm. by 8 cm. by 4·5 cm., covered with muslin of 1 mm. mesh served for breeding; 15 to 20 flies could be kept in one such cage. The flies were fed by applying the cage against the shaved abdomen of an animal. The larvae deposited in the cage made towards a corner to become transformed into pupae.

It was again demonstrated by the author that Glossina can be nourished on nothing else but blood. They could also be fed on citrated blood through a piece of chamois leather. The males and fertilised females during the laying period fed daily; the females, however, refused to bite the day before hatching a larva. Females not fertilised or not laying fed much less frequently, at intervals varying from one to seven days. The flies fed equally well on fowls as on guinea-pigs and rabbits. Although the incubator-bred flies appear to withstand the artificial conditions quite well and even attain in some cases a remarkable longevity the brood remained limited to about 20 flies per month. This is due to the short life and small productivity of the females and to the relatively large number of sterile pupae.

About two-thirds of the females did not live more than two months. Two flies showed an unusual longevity in that they lived for over five months. STUHLMANN, in the case of *G. brevipalpis*, observed a maximum lifetime of 3½ months. BOUET in Dahomey noted a maximum of four months for *G. palpalis*; KLEINE and FISCHER observed a similar duration (143 days).

Over a third of the pupae produced did not undergo further development. The large mortality among pupae bred artificially is most probably due to the bad conditions of deposition, the larvae often failing to find suitable places to become transformed into pupae.

Copulation takes place without any difficulty in the cages a few hours after the birth of the females. Larvae are hatched on an average from 15 to 20 days after copulation and pupae follow each other very regularly every 9 to 11 days. The majority of the larvae are laid between 5 and 6 p.m. In the Nigerian Soudan the author had noted that the *morsitans* laid every eight to nine days at 32° C. average daily temperature. KINGHORN in Rhodesia noted a great irregularity in the deposition of larvae of the same species and gives an interval of 14 to 15 days as normal for successive layings in laboratory conditions.

The majority of flies did not produce altogether more than five pupae each. Two, however, gave birth to 12 and one, in the course of a lifetime of 5½ months, produced the large number of 14 pupae. Some females were affected with sterility due to some unknown cause. The end of the brood was marked by considerable diminution in laying on the part of the females. The sterile females were found to have normal ripe eggs in the ovaries but these did not, however, descend into the uterus.

Changes of host for feeding purposes did not lead to more frequent laying. After the last laying the flies usually fed very irregularly.

The author never found the larvae of *G. morsitans* to produce a fluid secretion as described by LAMBORN and other observers.

The duration of pupation was on an average 30 days; the period was always longer for males than for the females. In the Nigerian Soudan the period was found to be from 23 to 28 days on account of the high average temperature (32° C.). LLOYD gives 21 to 25 days at 30° C., while KINGHORN noted a much longer period, 47 to 53 days, at laboratory temperature. NEWSTEAD gives 24–26 days as the duration of pupation in *morsitans* in Nyasaland.

With regard to the relative number of the sexes the author was able to confirm the views of other observers that the two sexes are equally numerous in artificially bred Glossina. The end of the brood was, however, marked by a characteristic preponderance in the number of males (out of 16 adult flies there were 15 males and 1 female, which did not survive). This sudden disappearance of females could not be accounted for and was the principal cause of the failure to carry on the breeding.

The author failed to infect his flies with *T. rhodesiense* and *T. brucei*, Uganda strain. Experiments were made in connection with the infection of pupae by means of a Chalcid parasite of muscids. The chalcid was found to lay its eggs in the pupa of *G. morsitans* as easily as in those of Calliphorina, the genus usually invaded. However, the individuals which develop inside the *morsitans* pupa cannot penetrate its thick covering and become liberated when they arrive at the adult stage. All the pupae bitten were killed, but none of the parasites emerged as they all died in the interior of the pupae. This experiment thus shows that it is impossible to employ these parasites for the destruction of *morsitans* pupae as proposed by AUSTEN.

YAKIMOFF (W. L.). **Les tiques des animaux domestiques du Turkestan russe.** [Ticks of the Domesticated Animals in Russian Turkestan.] —*Bull. Soc. Path. Exot.* 1917. Apr. Vol. 10. No. 4. pp. 298–301.

In the first part of this article a list of the various species of ticks identified by the author himself on domesticated animals in Russian Turkestan is given. The article is supplemented by tables showing the distribution of ticks in Russia, and for purposes of reference one of these tables is reproduced as follows:—

"*I.—List of genera and species of ticks found in Russia.*

"IXODINI.

"*Ixodaria.*

"Genus: *Ixodes* Latreille.

"*Ixodes arcticus* Herb. Osborn.—The Poibylevy Islands (according to NUTTALL).

"*I. arenicola* Eichw.—Borders of the Caspian Sea and Podolia (doubtful species; according to NEUMANN, probably *Hyalomma aegyptium*).

"*I. berlesei* Birula.—Borders of Angara (according to NEUMANN the description and figures are insufficient for identification).

"*I. cornuger* Kol.—Caucasus (doubtful species; according to NEUMANN, probably *Hyalomma syriacum*).

"*I. andyptidis* var. *singnatus* Birula. — Ungalaschka (Aleontian Islands).

"*I. hirsutus* Birula.—Ungalaschka, Eastern Siberia

"*I. reduvis* L.—Caucasus, government of Kieff, Kursk, Nijni-Novgorod, Riassan and north-west, and Finland.

"*I. spinocoxalis* Neumann.—Caucasus.

"*I. trianguliceps* Birula.—Borders of Lake Onega (doubtful species; according to NEUMANN, probably *I. tenuirostris*).

"*Rhipicephaloria.*

"Genus: *Rhipicephalus* C. L. Koch.

"*Rhipicephalus bursa* Can. and Franz.—Caucasus.

"*Rh. rossicus* Yakimoff and Kohl-Yakimoff.—Government of Saratow.

"*Rh. sanguineus* Latr.—Caucasus.

"*Rh. simus* Koch.—Turkestan.

"Genus: *Margaropus* Karsch.

"*Margaropus annulatus calcaratus* Birula.—Caucasus, Turkestan.

"Genus: *Hyalomma* C. L. Koch.

"*Hyalomma aegyptium* L.—Government of Astrachan, Kherson and Tschernomorsk, Caucasus, Siberia, Turkestan.

"*Hyalomma syriacum* Koch.—Caucasus Turkestan.

"*Amblyommataria.*

"Genus: *Aponomma* Neumann.

"*Aponomma crassipes* Neum.—Steppes of Kirghises (?)

"Genus: *Dermacentor* C. L. Koch.

"*Dermacentor reticulatus* Fabr.—Government of Kursk, Mohilev, Riasan, Saratow and Kherson, oblastes Primorsk, Caucasus, Siberia, borders of Amur, Turkestan.

"*Dermacentor variegatus* var. *kamschadalus.*—Kamchatka.

"Genus: *Haemaphysalis* C. L. Koch.

"*Haemaphysalis ambiqua* Neum.—Caucasus (?)

"*H. concina concina* Koch.—Poland.

"*H. concina kochi* Neum.—Amur.

"*H. flava* Neum.—Caucasus.

"*H. leporis* Pack.—Caucasus.

"*H. neumanni* Dönitz.—Government of Primorsk.

"*H. papuana* Thorell.—Caucasus.

"*H. punctata* Can. and Franz.—Government of Kherson, Caucasus.

"ARGATINI.

"Genus: *Argas* Latreille.

"*Argas persicus* F.-W.—Government of Saratow, Caucasus, and Turkestan.

"*A. reflexus* Fabr.—Town of Odessa.

"Genus: *Ornithodoros* Koch.

"*Ornithodoros canestrini* Birula.—Caucasus.

"*O. tholozani* Lab. and Megn.—Caucasus.

"*O. talayae* Guér.—Borders of the Aral Lake."

SWEET (Georgina) & SEDDON (H. R.). **The Viability of *Melophagus ovinus* Linn., the Sheep Louse-Fly, Sheep Ked, or Sheep-" Tick."** —*Vet. Jl.* (*with Australian Supplement*). 1917. Apr. Vol. 73. No. 4. pp. 6–14. With 3 tables.

The only work recorded on this subject appears to consist of the rather crude experiments of CURTIS and SWINGLE. Both these authors found that the " tick " died off within four days when taken off the sheep. SWEET and SEDDON performed a number of small experiments with lots of 20 ticks each taken from unshorn sheep in November (Australian summer, weather wet and mild). In these experiments all the " ticks " were found dead, when kept in the conditions enumerated, within the following time limits:—moist grass in cellar 6¾ days; moist grass on lawn 5¾ days; dead leaves on soil on lawn 2¾ days;

dead leaves on soil in cellar 11¾ days; bare soil on lawn 2¾ days; bare soil in cellar 11 days; wool in laboratory 3¾ days; wool in cellar 4 days.

The authors draw up the following provisional conclusions :---

"A moderately cool uniform temperature is the most favourable condition for the persistence of the 'tick' off the sheep and without food, especially if it be dry.

"If extremes of temperature be present then moisture is necessary, dryness soon proving fatal.

"The life of 'ticks' in shed wool is short under uniform temperatures, whether cool or moderate.

"The state of nutrition does not seem to have influenced the viability of these 'ticks.'"

ADERS (W. M.). **Insects Injurious to Man and Stock in Zanzibar.**—*Bull. Entom. Res.* 1917. May. Vol. 7. Pt. 4. pp. 391–401.

Over a half of this paper is devoted to an enumeration and description of the gnats and mosquitoes of Zanzibar and Pemba Islands; seven species are described as occurring in Zanzibar town while 39 species were identified altogether on the islands.

Tabanidae are found in abundance in wooded areas close to streams and marshes in various districts in both islands. A few species were captured in open arid or grassy country. Their prevalence varies with the seasons and they are very abundant for about six weeks after the rains. Ideal weather conditions are slight showers of rain with intervals of sunshine. During heavy rain or high wind they may appear to be altogether absent. These flies have not been definitely proved to play a part in the spread of disease in Zanzibar but there is a certain amount of evidence that they are capable of acting as carriers of *T. pecorum*, the common trypanosome of stock in the island. Repeated efforts have been made to prove this experimentally but owing to the extreme difficulty of keeping these flies alive in captivity and inducing them to bite experimental animals, no positive results have yet been obtained. Seventeen species were altogether identified. The commonest tabanid is *Tabanus taeniola* P. de B. which often attacks man; when alighting on cattle it nearly always selects the lumbar region, seldom the legs, and becomes engorged in about 2½ to 3 minutes; in mixed herds of cattle and domesticated buffaloes the latter are always singled out for attack as they seem more callous to the bites. The small species, *T. par* Walk. has a wide distribution throughout the two islands; it nearly always feeds on the withers and hocks of cattle. *T. gratus* Lw. was observed in large numbers in various districts of both islands. *T. biguttatus* Wied., another common species, generally feeds on the hump of cattle seldom attacking any other part; engorgement in some cases takes 4½ minutes; males were taken on tree trunks in proximity to grazing grounds. *Aegophagomyia pungens* Aust. is a common species along the littoral of both islands and appears to be very little affected by high wind; on several occasions it was noticed feeding on goats. *Haematopota decora* Walk., the only species of this genus found, is very prevalent throughout the whole year and generally feeds on the hocks and withers of cattle, engorgement taking place in about 2½ minutes; this insect lives moderately well in captivity and has been used on many occasions in captivity experiments.

Chrysops longicornis Macq. is very common on both islands throughout the whole year; as many as 30 were captured in a few minutes on one donkey; its withers and hocks were smothered with them; once they have started feeding nothing disturbs them and they must be almost brushed off.

Muscidae.—The distribution of ten species is given. *Stomoxys calcitrans* L., occurs everywhere in the island where cattle are found. "Larvae have been found in recent moist droppings; manure pits swarm at all times of the year with larvae and pupae. Animals somewhat out of condition are especially singled out for attack, and this is a useful diagnostic sign when looking over a herd for a suspected trypanosome case. The following non-biting Muscids have been noticed feeding in association with *S. calcitrans*, licking the droplets of blood left from the Stomoxys puncture:—*Musca domestica, Pycnosoma putorium,* and *Biomyia tempestatum.*"

Oestridae. "*Oestrus ovis* L. Large numbers of larvae have been taken from the frontal sinuses of goats; in some cases they had penetrated to the base of the horn, but they do not seem to cause any appreciable damage to their hosts. The pupal stage averages 19 days. Very common throughout the island. *Gastrophilus asininus* Br.—A few adults have been taken flying around cattle and donkeys."

One species of Drosophilidae and five of Hippoboscidae were identified. The number of Hippoboscids taken was surprisingly few and the author believes that a moist damp climate like that of Zanzibar is inimical to their development. *Hippobosca maculata* Leach, is common in cattle, horses, and donkeys; *Lynchia maura* Bigot., is common on domesticated pigeons.

Of fleas and lice, *Ctenocephalus canis* Curtis is found on dogs and large numbers have been taken from goats; *C. felis* Bouché, from goats; *Dermatophilus penetrans* L. is common and has been taken on two occasions from dogs; *Echidnophaga gallinacea* Westw., is very common on fowls especially on the bare parts of the head and around the eyes, while several specimens have also been taken from the common town rats. *Haematopinus tuberculatus* N. is common on domesticated buffaloes; *Liognathus vituli* L. was found on calves.

The following is a list of the ticks identified:—

"*Rhipicephalus appendiculatus*, Neum. The commonest species on cattle; undoubtedly the carrier of African coast fever.

"*Rhipicephalus simus*, Koch. Taken on cattle and donkeys.

"*Rhipicephalus sanguineus*, Latr. Very common on dogs.

"*Rhipicephalus evertsi*, Neum. Common on cattle, goats and sheep. Generally found around the anus or in the ears.

"*Rhipicephalus pulchellus*, Gerst. A rare form in Zanzibar. Numbers can be found on cattle imported from the Somali Coast, including replete females. This tick, probably owing to climatic conditions, has been unable to acclimatise itself on the Island; no specimens have been obtained from local stock.

"*Rhipicephalus maculatus*, Neum. From domesticated pig.

"*Boophilus decoloratus*, Koch. Abundant on cattle.

"*Boophilus australis*, Fuller. From local cattle.

"*Amblyomma variegatum*, F. Taken from cattle, goats, sheep and camels.

"*Amblyomma hebraeum*, Koch. A rare species; a few have been obtained from cattle.

"*Hyalomma aegyptium*, L. A number have been collected from camels; on other domesticated animals they seem to be rare. I am inclined to think that this species, like *R. pulchellus*, has been unable to acclimatise itself.

"*Haemaphysalis leachi*, Aud. Very common on dogs.

"*Haemaphysalis bispinosa*, Warb. From imported Indian cows."

BODKIN (G. E.) & CLEARE (L. D., Jnr.). **Notes on some Animal Parasites in British Guiana.**—*Bull. Entom. Res.* 1916. Oct. Vol. 7. Pt. 2. pp. 179–190. With 1 map & 3 text figs.

The following are among the more important of the species identified by the authors as affecting the domesticated animals:

"Nematoda.—*Filaria cervina*, Duj. A single specimen of this parasite was obtained from the abdominal cavity of a cow at the Georgetown Abattoir. It does not appear to be a common species.

"*Filaria immitis*, Leidy. It would probably be a difficult matter to find a creole dog over two years in age which does not harbour this parasite. Dogs about two years old generally possess at least one adult worm in the heart itself or in the pulmonary artery. In old dogs a thick tangled mass of the worms is often found in these organs, which would appear to choke them completely. However, the presence of this parasite seems to have but little effect on the general well-being of the dog. Imported dogs seem to thrive and are not rapidly killed by this worm as has been reported from China. The mosquito, *Culex fatigans*, Weid., is the probable vector of the disease.

"*Ascaris megalocephala*, Cloquet. One specimen of this large worm was obtained from a horse after the administration of a purgative.

"*Ankylostoma* sp. A common species, resembling *A. ceylanicum*, Loos, in the intestine of most dogs. As many as 15 of these worms have been taken from one dog.

"*Physaloptera ? praeputialis*, Linst. An exceedingly common parasite in the stomach of most cats. From 4 to 12 of these worms are usually found firmly attached to the stomach wall. Lutz has recorded the occurrence of this parasite in Brazil in the same host.

"Platyhelminthes.—*Dicorcelium* sp., near *D. lanceatum*, Stiles & Hassall. This parasite seems to be extremely prevalent among cats in the colony. At times the liver will be found to be very heavily infested, while in other cases only a few flukes will be found.

"Cestoda.—*Moniezia expansa*, Rud. This species was taken from a pig at the Georgetown Abattoir. It is not normally a parasite of the pig, but it is possible that in some manner or other the worm as excreted from its original host may have been consumed by this animal, as pigs are notorious eaters of all kinds of refuse and filth

"Acanthocephala.—*Echinorynchus gigas*, Goeze. This appears to be a common inhabitant of the small intestine of pigs in British Guiana; numerous specimens have, on various occasions, been obtained from pigs slaughtered at the Georgetown Abattoir.

"Acarina. Ixodidae.—In British Guiana all kinds of live-stock are attacked by various species of ticks, which are in many cases directly responsible for a very considerable annual financial loss. Preventive measures, such as dipping, are quite unheard of and the presence of these pests is universally regarded with the utmost indifference.

"*Argas persicus*, Wald. This tick is a common inhabitant of fowl-houses throughout the Colony, and the larvae are to be found on most varieties of poultry. The larval stage of this tick is known locally as 'Nimbles.'

"*Rhipicephalus sanguineus*, Latr. One of the commonest external parasites of dogs. All stages of development may be found on this animal. Between the digits and within the ears are favourite points of attachment.

"*Margaropus annulatus* var. *australis*, Fuller. Flourishes on all kinds of cattle. Steers that have been in the pastures for a few months soon become heavily infested and thereby lose weight and condition. Instances have been observed where several ticks have attached themselves to the eyelids and engorging there caused intense irritation. The death of a calf through tick infestation is not uncommon. The institution of properly constructed dipping or spraying contrivances would handsomely repay the initial outlay. This tick has a number of other hosts, including the common toad or "Crapaud" (*Bufo marinus*).

"Diptera. Tabanidae.—Within the coastal region the Tabanidae are of common occurrence, though they are chiefly composed of large numbers of a few common species. Within the forest areas, however, these coastland species seldom appear and their place is taken by numerous other species, some of which are comparatively rare. According to information received, the savannah lands near the Brazilian border are particularly rich in Tabanidae, but up to the present no opportunity has occurred for collecting or making definite observations within this area.

"The common species of Tabanidae that attack live-stock on the coastlands belong to the genus *Tabanus*—*T. trilineatus*, Latr., *T. senior*, Wlk., and *T. semisordidus*, Wlk.; of these *T. trilineatus* is possibly the commonest and most widely distributed.

"The numerous muddy trenches and ditches that are necessary for drainage purposes all over the coastal area, and more especially in the cultivated portions such as the sugar estates, provide very suitable breeding places for these flies, but very little is known of their life-histories; a wide and fascinating field for research is thus presented.

"A recent outbreak of Mal de Caderas (*Trypanosoma equinum*) amongst the sugar plantation mules was in all probability propagated by biting flies, and most of the common species of Tabanidae and other biting flies, such as the well-known *Stomoxys calcitrans*, L., were observed to feed freely on mules afflicted by this deadly equine disease.

"The principal enemies of Tabanidae are several species of the large predaceous wasps belonging to the Bembecinae. These, owing to their characteristic yellow and black coloration and fierce habits, have received the peculiar Creole name of 'Cowfly tiger.'

"Wherever Tabanidae occur, large numbers of these wasps will be observed to be active, especially round cattle and mules when in the pastures. Despite the loud buzzing flight and active darting movements of their enemies, the Tabanidae seldom display any concern at their presence, though they take good care to choose those portions of their host least exposed to the manoeuvres of the wasps. They are always more numerous on sandy soils, which provide greater facilities for their nesting habits. . . .

"Muscidae.—*Stomoxys calcitrans*, L. In all parts of the coastal area and in many of the inhabited areas of the inland regions this fly is of common occurrence. About stables in Georgetown, and particularly about the mule stables and compounds on the sugar estates, numbers of these flies are continually active, more especially in the early morning and evening hours. In the absence of other food supplies it will readily attack human beings and often proves most irritating. No decided increase in its numbers has been observed at any special season of the year.

"Hippoboscidae. A number of these flies are known to infest different kinds of birds and some mammals, but their activity, and the manner in which they quickly leave their host at its death, renders their capture extremely difficult.

"*Lynchia maura*, Bigot. Frequently found on domestic pigeons.

"Sarcopsyllidae.—*Dermatophilus penetrans*, L. This well-known species is widely distributed over the Colony. They are known locally as 'Jiggers' or 'Chigoes.'

"Pulicidae.—*Ctenocephalus felis*, Bouché. Probably the commonest species on the coast-lands. It is the common flea of domestic cats and dogs and occasionally attacks man.

"Haematopinidae.—*Haematopinus eurysternus*, Nitzsch. Collected from cattle on the coast-lands. It is the common cattle louse.

"*Haematopinus tuberculatus*, Nitzsch. This species was collected from imported Indian buffaloes, which apparently are the only hosts in British Guiana.

"*Haematopinus suis*, L. Very common on pigs. It was collected several times on these animals at the Georgetown Abattoir.

"Mallophaga. This order is well represented in British Guiana. From the economic standpoint the presence of ill-kept and overcrowded fowl-houses and pigeon-lofts and pens of a like character for sheep and goats accounts largely for the abundance of these parasites and for their wide distribution among domestic animals.

"Some species of birds in the wild state appear to be heavily infested with lice, while others again are almost entirely exempt.

"*Trichodectes pilosus*, Gieb. On donkey (*Equus asinus*).

"*Trichodectes climax*, N. On goat (*Capra hircus*).

"*Trichodectes sphaerocephalum*, N. On sheep (*Ovis aries*)."

Various species of other families of Mallophaga affecting several kinds of birds and the guinea-pig are then given.

EPIZOOTIC LYMPHANGITIS.

CHATELAIN (P.). **Considérations générales sur le traitement de la lymphangite épizootique.**—*Rev. Gén. Méd. Vét.* 1917. July 15. Vol. 26. No. 307. pp. 289–293.

In this preliminary note the author first discusses some of the characteristics presented by the disease according to his observations in Morocco. In order that the disease may assume an acute form two factors are necessary: (1) a warm country, (2) a damp climate. In Morocco the disease occurs in a particularly serious form along the coast, whereas in elevated districts at some distance away it is less severe and often becomes cured spontaneously. Flies abound in the hot, humid districts throughout the year and, after a case of epizootic lymphangitis has been observed, it is not rare to find the disease appearing after 20 to 60 days in horses bearing harness wounds and not brought into contact with the affected animals.

Potassium iodide gave no good results in the author's hands but caused the animals treated to become extremely restive. Biniodide of mercury gave only partial success. "606" likewise failed to give the expected results. Treatment by means of iodine and methylene blue employed after dilaceration of the tissues in early or localised cases gave excellent results. In the elevated districts this treatment cured all the affected animals. 350 cases were treated at a hot and damp centre near the coast with 86·2 per cent. recoveries in from 30 to 40 days, 11·1 per cent. in from 40 to 110 days, while 2 per cent. were slaughtered on account of generalisation. 85 per cent. of these cases were brought in from districts along the coast and 15 per cent. from elevated districts. The same treatment employed at Casablanca failed to give the same results; VELU, who tried other treatments especially with novarsenobenzol, in the same conditions, failed to get the expected results.

In France the iodine-methylene blue treatment was applied in the Somme region and gave good results. The author claims that typical epizootic lymphangitis can be distinguished clinically in that the hair becomes shed at a spot and then a bud develops raising the skin, which becomes brilliant in appearance. A bud resembles a black grape with the dust wiped off and bursts spontaneously two or three days afterwards discharging a yellowish, granular pus from a crater-like ulcer with raised and thickened borders. In the so-called ulcerative lymphangitis the buds are generally situated on a limb, often causing lameness. They are developed underneath the skin and are only revealed on palpation. The hair does not fall from their surface. After two or three days the abscess spontaneously bursts discharging a yellowish, sticky, often sanguinolent pus; the abscess becomes rapidly closed if treated with antiseptics but almost immediately it has cicatrised a new abscess develops a short distance away. The animal is lame when the buds form in the neighbourhood of a joint.

The author records a couple of cases of ulcerative lymphangitis successfully treated by means of the iodine-methylene blue method.

The author thus recommends that every horse not reacting to mallein and showing a number of multiple abscesses developing in echelon on a limb should receive two injections of 10 cc. of 1% methylene blue intra-muscularly at three days' interval. A cure is obtained in a few days without any local treatment except washing with weak antiseptic solutions such as tincture of iodine.

TRUCHE & GUIGNARD. **Contribution à l'étude de la lymphangite épizootique.**—*Bull. Soc. Cent. Méd. Vét.* 1917. Jan. 4. *Rec. Méd. Vét.* 1917. Jan. 30–Feb. 28. Vol. 92. Nos. 3 & 4. pp. 64–68.

In this short article the authors describe a series of eleven observations on the treatment of epizootic lymphangitis occurring in horses which had been cast from the French army in France. Various products recommended by French authors were tried, viz., luargol, potassium iodide, novarsenobenzol, and galyl. The use of galyl by DOUVILLE in the treatment of this disease has already been referred to in this *Bulletin* [Vol. 4, No. 3, pp. 111]; out of five cases treated exclusively with this drug four recovered completely and one showed considerable progress. The cryptococcus was demonstrated in each case. The authors' conclusions are as follows:—

> Epizootic lymphangitis is amenable to treatment by means of galyl.
>
> Small doses, even frequently repeated, and large doses given at too long intervals did not give appreciable results; it is preferable to inject at once at least three grammes on the first two occasions at intervals of a week. The tolerance of animals for this product being very great there is no harm in giving frequent doses.
>
> If a cure is not obtained after the first two injections one may recommence the treatment with 2 or 3 grammes without any danger.

PERRIN. **Notes sur la détermination de la période d'incubation de la lymphangite épizootique en France.** [Length of the Incubation Period of Epizootic Lymphangitis in France.]—*Bull. Soc. Cent. Méd. Vét.* 1917. May 3. *Rec. Méd. Vét.* 1917. Apr. 30–May 30. Vol. 92. Nos. 9 & 10. pp. 191–194.

In a unit comprised of artillery horses in France the author had under his observation five cases which at different times contracted injuries affecting various parts of the body. These injuries healed after a few days but subsequent to healing swollen lymphatics were found to originate from the seats of the former injuries; the lesions thus set up were found to be due to epizootic lymphangitis. The length of time these lesions of epizootic lymphangitis took to develop after the healing of the wound would represent the minimum period of incubation, while the length of time from the infliction of the injury would correspond with the maximum period. For the five horses the maximum periods were thus, respectively, 127 days, with possible error below 15 days; 111 days, error below 24 days; 115 days, error below 15 days; 120 days, error below 7 days; 120 days, error below 15 days. This gives 118 days as the average maximum incubation period, which would be 15 days in excess of the minimum.

CHARMOY. **Sur la lymphangite épizootique.**—*Rec. Méd. Vét.* 1917. Apr. 15–May 15. Vol. 93. Nos. 7 & 8. pp. 179–196. With 5 figs. & 1 table.

The greater part of this paper is devoted to the symptomatology and lesions of the above disease, chiefly as they occur in army horses at the front in France. The disease is stated to be a common affection in certain of the French colonies (Algeria, Morocco and Senegal), but, before the war, it was almost unknown in France. It made its appearance among horses at the front towards the end of the year 1914 and from being rare and localised at that date it has now become so common and widespread that it constitutes a veritable danger for the cavalry.

The author had under his own observation a few interesting cases of generalisation and of lesions on the more rarely affected parts. Cases are thus depicted affecting the skin above and below the lips and closely resembling horse-pox lesions, lesions on the pituitary mucous membrane, and around the vulva. In one case on post-mortem a specific ulcer was found on the internal surface of the cricoid cartilage of the larynx. In two cases lesions of chronic endocarditis were found on the mitral valve of the left heart in the form of fibrous nodules about the size of peas, together with patches of endarteritis; these lesions, however, were not specific but in the nature of complications. No lesions were discovered in the lungs although in many cases purulent centres were discoverable in the pulmonary parenchyma, but these never revealed the presence of cryptococci.

With regard to treatment the author's experience has led him to adopt the surgical method wherever practicable. Various drugs recommended by different authors were tried but gave inconstant results. The ideal local treatment is stated to consist in the extirpation of all the affected parts and in the case of small lesions this method gives perfect results. When it was not possible to employ this radical method of treatment he attempted to sterilise the purulent centres by cauterisation, by the application of chemical agents, or by a combination of these two methods. In every such case the horse is cast and securely bound, a heated sharp-pointed cautery is then introduced into each abscess or into the opening of each ulcer: every protruding lymphatic is explored in the same way and it is then always found to reveal pus in its depth. The borders and depth of these lesions are well cauterised and the point of the instrument pushed as far forwards as possible within the interior of the lymphatic vessel. Excessive granulations are excised by means of the flat cautery.

With the aid of the ordinary cautery, or better by means of the auto-cautery, the author next inserts a series of fine points about 1 cm. from each other all round the affected part. This circle is circumscribed by a double or triple circle of punctures in order to prevent extension. A blister is then applied all over the cauterised surface. There is no risk attached to this no matter how extensive the surface treated. On the following few days there is an enormous reaction, then towards the 6th day or 7th day the reaction diminishes. The affected part is then treated by the application of antiseptics such as saturated alcoholic picric acid or methylene blue If fresh abscesses appear they are punctured by means of the pointed cautery. The author gives in a table a list of 48 animals treated as above; 29 were cured after a period varying from 20 days to 3 months, 8 were destroyed on account of the severity of the lesions and of the remaining 11 all, with the exception of 1, were gradually progressing towards recovery.

BRINGARD. **Un traitement de la lymphangite épizootique.**—*Bull. Soc. Cent. Méd. Vét.* 1917. June 7. *Rec. Méd. Vét.* 1917. June 30. Vol. 92. No. 12. pp. 216–224.

In this article the author describes a method of treatment adopted by him with successful results over thirty years ago in Algeria. His observations led him to conclude that the appropriate treatment consisted in the surgical extirpation of the swollen lymphatic vessel or its destruction by means of some procedure acting directly on the interior of its lumen. The drugs employed failed to give satisfactory results. The removal of the lymphatics by means of a bistoury is attended with grave risks on account of the damage done to the surrounding tissues, and of secondary infection.

The instruments thus used by the author consisted of iron rods about 18 inches long and about the thickness of a lead pencil provided with a wooden handle at one end. These rods heated white hot served to cauterise the whole of the interior of the lymphatic. The operation is easily performed; the horse is cast so as to expose the affected lymphatics. If the lymphatic is no more than about 9 inches long one excises the bud on the side away from the lymphatic gland and then inserts the heated rod into the exposed orifice and passes it along the interior of the channel up towards the centre of the lymphatic gland. When the affected lymphatic is longer the process is repeated two or three times by passing the rod each time from a distal bud to another situated more centrally. The rods may be curved in order to follow tortuous lymphatics. Cases where the buds are not connected by means of apparent lymphatics are inoperable by this method, but such cases are very rare, and do not exceed 5 per cent. During the first week after the operation an abundant suppuration takes place leading to the shedding of the cord and glandular congestion.

A 10 per cent. solution of tincture of iodine is afterwards injected into the channel. It is claimed that cures can be affected in four to five weeks in cases of horses refractory to all other methods of treatment.

Details are given of eight cases occurring in the French army; on these the author had the opportunity of again testing his method of treatment. The results again proved its efficacy as all the horses were cured in a comparatively short time.

FINZI (Guido). **Les composés du mercure dans le traitement de la lymphangite épizootique.** [Treatment of Epizootic Lymphangitis by means of Mercurial Compounds.]—*Bull. Soc. Path. Exot.* 1917. June. Vol. 10. No. 6. pp. 428–430.

Five seriously affected cases were successfully treated by the injection at short intervals of the following mercurial compounds:—6 per cent.

salicylate or 5 per cent. calomel in liquid paraffin intramuscularly, 1 per cent. perchloride or benzoate combined with cacodylic acid in watery solution, subcutaneously or intramuscularly. From ten to twelve injections of doses varying from 5 to 40 c.c. repeated in each case every two or three days were required to produce complete recovery.

FAVERO (F.). **L'arsenivan nella cura del farcino criptococcico.** [Treatment of Epizootic Lymphangitis by means of Arsenivan.]—*Moderno Zooiatro. Parte Sci.* 1917. June 30. Vol. 6. No. 6. pp. 129–136.

In this short article the author gives a review of the literature dealing with the treatment of epizootic lymphangitis and records observations of ten cases of the disease occurring in Italy. These were treated by means of an Italian arsenical preparation arsenivan – prepared at Parma University. Cures were obtained in all cases in from 11 to 30 days. The drug was well tolerated when administered by the digestive tract or intravenously, but produced moderately severe reactions when injected subcutaneously.

VELU. **Le traitement curatif de la lymphangite épizootique par la vaccinothérapie.** [Vaccine Treatment of Epizootic Lymphangitis.]—*Bull. Soc. Cent. Méd. Vét.* 1917. May 3. *Rec. Méd. Vét.* 1917. Apr. 30–May 30. Vol. 92. Nos. 9 & 10. pp. 195–204.

The vaccine is made up as follows:—Pus withdrawn aseptically is emulsified with 10 times its bulk of normal saline solution to which is added 0·25 per cent. carbolic acid and about 0·14 per cent. ether. The mixture is then filtered through several thicknesses of sterile open-wove gauze.

Subcutaneous inoculation of a suitable dose of this mixture sets up quickly a reaction manifested by very distinct clinical symptoms. A negative phase is first observed in which all the symptoms become aggravated—suppuration increases, the larger buds ripen and sometimes open, the affected lymphatics become more swollen and tender. This phase lasts three or four days, sometimes five or six. Its intensity varies with the dose of vaccine employed.

This phase then changes rather quickly—in 24 or 48 hours. The swelling around the lymphatics diminishes and buds appear which were not visible before the injection. Healing of ulcers is accelerated; secretions from open abscesses and large sores diminish to such an extent that local treatment is almost unnecessary. This positive phase lasts on an average from four to five days but it may vary from no time up to ten days; the disease then resumes its normal course. A repeated injection causes the same cycle of phenomena to appear but if it is performed before the end of the positive phase the negative phase following is somewhat delayed and it is less intense and does not last so long as in the case of the first injection.

The problem in the treatment of epizootic lymphangitis by means of vaccine therapy thus resolves itself into the determination of suitable doses and the intervals after which they should be renewed in order to set up mild negative phases and well marked positive phases. Velu, who has had very considerable experience with the disease in

Morocco, gives a record of eight seriously affected cases in which this treatment was carefully carried out. He considers that the record justifies the expectation of good results. The vaccines failed in each case where the affected animal was so weak in condition that it was unable to react. " A cure is thus not assured in every case but a great advance is made on the treatment of the disease by means of drugs and on the local treatment consisting in the application of antiseptics or excision of the lesions." Recovery was produced in the cases described within six weeks.

As the result of his experience Velu recommends the injection of 2½ c.c. of the vaccine and then allowing an interval of seven or eight days to elapse. If there is persistent aggravation of the symptoms the dose injected was too strong and a few days should elapse before injecting a smaller dose. If there is no change the dose injected was too weak, and a larger dose should be injected immediately. If there is distinct progress the dose is sufficient and should be renewed or slightly increased or decreased, according to the reaction which one desires to set up. A cure can be obtained in this way after 30 to 40 days.

BACTERIAL DISEASES.

TRUCHE (C.). **Traitement bactériothérapique de la lymphangite ulcéreuse.** [Vaccine Treatment of Ulcerative Lymphangitis.]—*Ann. Inst. Pasteur.* 1917. May. Vol. 31. No. 5. pp. 209–214.

The above disease has apparently assumed a very serious character among army horses in France; the author claims to have obtained distinctly satisfactory results in treatment by the use of dead cultures of the organism isolated from the lesions, viz., the Preisz-Nocard bacillus.

M. NICOLLE, LOISEAU and FORGEOT observed a very high specific antitoxic power in the serum of infected animals. This was equal to or even higher than that of horses immunised by CARRÉ by means of filtrate. These authors, however, showed that the serum of affected animals was devoid of anti-bacterial properties.

Cultures were obtained by growing the organism, maintained in the laboratory on solid serum, on potato agar in Roux flasks incubated for 24 hours at 37° C. The bacterial growth is twice washed by emulsifying in salt solution and centrifugation. The bacteria are then killed by adding equal quantities of alcohol and ether and allowing to stand for 24 hours. The overlying liquid is then poured off and the bacteria dried at 37° C. The vaccine is prepared for use by emulsifying the powder in normal salt solution, 1 centigramme per 1 c.c., and distributing in ampoules which are heated to 100° C. for four or five minutes.

The dose of vaccine is 1 centigramme inoculated every week under the skin of the neck. A small swelling forms at the seat of inoculation. " One may see the buds shrink, suppuration dry up, and the cords disappear after the second injection, but recovery usually takes place after the third." A number of figures are given showing the results of this treatment. In one lot, out of 43 animals treated, after the third injection 14 were completely cured, 23 were in various stages of recovery, while the remainder died from various causes or were killed on account of debility.

[This mode of treatment is not new. Dead cultures were used by MONTGOMERY in British East Africa for the treatment of a cutaneous disease of equines from which the Preisz-Nocard bacillus was isolated (see this *Bulletin*, Vol. 5, No. 1, pp. 64).

We cannot see the force of using the alcohol-ether mixture "in order to eliminate the life (that is to say, the virulence) of the germs without changing their antigenic qualities, etc.," if before injection they are heated to 100° C. for five minutes, and still maintain the desired properties.—ED.]

TRAWIŃSKI (Alfred). **Ueber das Vorkommen von Bakterien der Typhus-Coligruppe im Darminhalt gesunder Schweine, zugleich ein Beitrag zur Differenzierung der Bakterien der engen Paratyphus B.-Gruppe.** [Bacteria of the Typho-Coli Group in the Intestinal Contents of Healthy Pigs; Differentiation of the Bacteria of the Small Paratyphoid B. Group.]—*Zeitschr. f. Hyg. u. Infektionskr.* 1917. Jan. 10. Vol. 83. No. 1. pp. 117–176. With 24 tables & 6 text figs.

The question as to whether bacteria of the paratyphoid B. group can be found in the intestines of healthy pigs has already been investigated by several authors (DORSET, UHLENHUTH, and others). The material used by the author for ascertaining the presence of these bacteria was obtained from the contents of the jejeunum, colon, and caecum of apparently healthy pigs which had been brought in for slaughter to the abattoirs from places free from disease and kept under observation for about 10 days before slaughter. The suspected colonies obtained on sowing out this material underwent a long series of searching laboratory examinations.

The author's conclusions are as follows :—

(1) From the intestinal contents of 500 healthy slaughtered pigs were grown 26 strains (5·2 per cent.) which from the appearance of the colonies, biological characters, agglutination tests, and partly according to their pathogenicity fell into three groups.

(a) Two strains belonged to the small paratyphoid B. group and were identical with *B. suipestifer* from the appearance of the colonies and partly also from the results of agglutination tests and pathogenicity towards white mice.

(b) Eight strains which formed a uniform type of colony differed in their biological characters from representatives of the small paratyphoid B. group only in so far as that they did not ferment sorbite ; serologically they showed an affinity towards *B. aertryk* (de Nobele) and partly also towards *B. suipestifer*. 62.5 per cent. of these strains were pathogenic for white mice. They formed indol and should be classed with the paratyphoid-like strains.

(c) Sixteen strains possessed a common type of colony and differed biologically from representatives of the small paratyphoid B. group in that they did not ferment dulcite and sorbite. They were agglutinable with the anti-sera of representatives of the small paratyphoid B. group. Their own anti-serum agglutinates the strains of this group very highly but has no influence on representatives of the small paratyphoid B. group ; the strains of the second group were partly agglutinated and partly not influenced. In all the strains a positive indol reaction was obtained ; 12·5 per cent. were pathogenic for white mice. They were recognised as pseudo-paratyphoid strains.

(The strains belonging to the second and third group could not be placed in the system of classification of the typho-coli group according to Weber and Haendel or Gildemeister and Baerthlein, for they did not completely correspond culturally with *B. paratyphosus* B.)

(2) The representatives of the small paratyphoid B. group (*B. paratyphoid* B., *B. aertryk* de Nobele, *B. suipestifer*, *B. typhomurium*, and *B. psittacosis* Nocard) cannot be sharply distinguished from each other by means of their morphological, biological, and serological (agglutination, Castellani's test) properties, nor according to their pathogenicity, but that differentiation is possible is shown by the results obtained from examining the types of colonies.

HARDENBERGH (J. B.) & BOERNER (Fred Jr.). **Vaccinations against Hemorrhagic Septicemia, No. 2.**—*Jl. Amer. Vet. Med. Assoc.* 1917. Mar. Vol. 50. (New Series. Vol. 3.) No. 7. pp. 868–876. With 2 tables.

In a previous report the authors published an account of work carried out by them for the Pennsylvania State Live Stock Sanitary Board for the year 1915. Vaccination during that period was carried out by means of living 48 hour broth cultures of *Bacillus bovisepticus* isolated from outbreaks of haemorrhagic septicaemia. No special measures were taken to attenuate the organism as experience had shown that no method of attenuation was capable of producing strains that would furnish uniform results. The only test to which the inoculation material thus complied was that it should be virulent for rabbits and guinea-pigs but not for sheep and calves. The use of living vaccines would ordinarily appear to give far better results than the use of killed or modified vaccines as the latter most probably lose their antigenic properties to a considerable extent. One of the drawbacks in connection with the use of living vaccines, however, lies in the fact that centres of infection may be established, but the experience gained in 1915 showed that no fresh cases occurred during the following year among the vaccinated herds.

Vaccination was carried out in the same manner during the year 1916 in a total of 31 herds. The first 11 vaccinated herds, termed "exposed" herds, contained steers that had passed through public stockyards, become infected, and been taken to the farms and mixed up with the native cattle. These herds contained altogether 265 animals; six deaths occurred prior to vaccination, and 24 animals were sick at the time of vaccination. With the exception of one sick animal all were vaccinated; only one death afterwards occurred in the herds.

The remainder consisted of native herds in the mountainous districts of Pennsylvania in which the disease appeared during the months of June to October; there were 53 deaths before vaccination and 19 sick at the time of vaccination. Twenty deaths occurred following the treatment.

During the two years 1915 and 1916, 25 native sick animals at pasture were vaccinated and of these 13 succumbed to the disease. In 1916, 22 out of 23 sick vaccinated steers recovered; these were suffering from the chronic pulmonary form of the disease and had been exposed to infection in stock yards. This chronic form of the disease is seldom seen on pasture, the acute form being observed instead. The authors conclude that the vaccine may have some therapeutic value in chronic cases.

The complete absence of haemorrhagic septicaemia in 1916 in the herds vaccinated in 1915 might indicate that considerable immunity had been conferred on the animals; however, the absence of the disease also from a number of control herds left unvaccinated and kept under observation during 1916 invalidates such a deduction.

The authors propose to carry on further experiments in this connection.

MOHLER (J. R.). **American Veterinary Medical Association. Report of Committee on Diseases.**—*Jl. Amer. Vet. Med. Assoc.* 1917. Mar. Vol. 50. (New Series. Vol. 3.) No. 7. pp. 895–904.

The information regarding the following three diseases is extracted from the above report.

Haemorrhagic septicaemia. (Stock-yard fever, shipping fever, contagious pneumonia).—An unusually large number of cases of this disease occurred during the autumn of 1915 and spring of 1916. The disease appeared among cattle in public stock markets or in shipments that had been recently handled through public stock yards and it was believed that the infection was picked up in the stock yards or from the trucks in which the animals were transported. Frequently native cattle became infected within a week after coming in contact with other animals that had contracted the disease from stock-yard exposure. In some instances native cattle appeared to become infected after the recent admission of cattle from stock-yards, although no visible symptoms of the disease could be detected in the latter animals. Examination of the lesions showed that the disease was caused by *Bacillus bovisepticus.* In several instances infected cattle transmitted the disease to sheep upon the farms into which they were brought and in one instance a colt which was running with diseased sheep became infected. The disease has been recognised in the United States for the past 20 years; a few outbreaks have occurred every year, but the losses were unusually large during the past year and the application of quarantine measures is contemplated in some States in order to prevent further outbreaks. All cattle are susceptible but young animals are more susceptible than adults. Cows in which the vitality has been lowered by heavy milking and exposure by standing in yards during cold and stormy weather proved very susceptible. The most serious outbreaks occurred among store cattle in poor condition, especially if kept in a crowded shed for some time prior to sale. Examination of carcases at abattoirs often showed lesions of haemorrhagic septicaemia in cattle which were kept for 7 to 10 days in pens prior to being sold, whereas no lesions could be found in cattle slaughtered within three or four days after entering the yards.

The loss from the disease ranges from 2 to 20 per cent. of the herd although the mortality among affected animals is from 70 to 90 per cent. The mortality is not alarming in view of the large number of cattle that pass through the public stock-yards of the country, although in several instances losses from death were reported amounting to 50 per cent. of a herd. Vaccination by means of so-called " bacterins or dead bacterial products has been adopted but as the outbreaks in untreated herds usually terminate abruptly with losses varying from

2 to 20 per cent. the value of the preventive treatment is not definitely known." . . .

"*Dourine.* Dourine in horses has increased somewhat in prevalence in certain states during the past year. This condition is due to the spread of the disease among the horse stock of the Indian reservations and to the inability of the Bureau of Animal Industry to prosecute vigorously the work of inspection and eradication at the round-up season because of lack of funds. Of 45,100 samples of blood serum tested by complement fixation by the Bureau during the fiscal year ending June 30, 1916, 1,400 gave positive reactions. This is 3·1 per cent, as compared with 2·7 per cent for the preceding fiscal year. The infected states are Montana, Wyoming, North Dakota, South Dakota, Nebraska, and Arizona. Notwithstanding the difficulties, good results have been accomplished in the work of eradication.

"*Swamp Fever* [Infectious Anaemia of Equines]. That swamp fever is of increasing economic importance is evidenced by the fact that it has gained a foothold in New York, where it was not recognised prior to 1914. That the diagnosis should have been confused with 'other septicemic diseases,' suggests that there may be still other localities where swamp fever may be present without having been recognised. Within the last 10 days this disease has been reported from Louisiana where it was causing considerable losses on at least one plantation.

"Unfortunately continued experiments in sero-diagnosis have thus far failed to yield a satisfactory diagnostic procedure. Likewise experiments in insect transmission of this infection have been entirely negative. A recent experiment has shown that an animal in good condition and without showing any outward appearance which would arouse suspicion, may retain the virus of swamp fever in the blood even after 6 years. The blood of this animal when inoculated into another horse produced swamp fever in 13 days. The former animal therefore furnished a source of infection for insects during 6 years, but during this time no spontaneous cases developed, even though healthy horses were kept in the same stable without protection against insects. During this time both *Tabanus* and *Stomoxys* flies have been present, as well as many other species of insects."

DISEASES DUE TO FILTERABLE VIRUSES.

MORI (Nello). **Rabbia e Setticemia emorragica in alcuni bufalotti.** [Rabies and Haemorrhagic Septicaemia in some Young Buffaloes.] —*Ann. Staz. Sperim. per le Malat. Infet. d. Best.* Naples. 1915. Vol. 3. No. 1. pp. 55–80.

A disease showing symptoms affecting almost exclusively the nervous system had caused the death of four young sucking buffaloes on a farm where there was no history of a previous occurrence of such a disease. About a month previously two dogs had presented clinical signs of rabies in this neighbourhood and had been destroyed. The heads of two of the calves were sent to the author for examination. No histological changes were seen in the brain.

In one case sub-dural inoculation of rabbits produced slight symptoms of intoxication immediately afterwards from which they recovered but died of paralytic symptoms about a fortnight afterwards. Inoculations by passage of brain material from these rabbits definitely demonstrated the presence of rabies virus in the brain.

In the case of the second calf inoculation of brain substance subdurally into rabbits produced violent symptoms of intoxication affecting the nervous system immediately after inoculation from which the animals died within five hours. No organism was cultivable from the blood or any of the viscera of the rabbits. These symptoms were also produced by the inoculation of the filtrate obtained by passing an emulsion of brain substance through a Berkefeld filter.

The brain of the first calf kept on an ice chest for three days, then emulsified and passed through a Berkefeld filter was also capable of setting up similar symptoms but to a far less degree.

Microscopic and cultural examination of the brains of both the young buffaloes revealed the presence of small numbers of a Pasteurella organism identical in appearance and cultural characters with *B. bubalisepticus*, the cause of "barbone," or buffalo plague. Inoculation and feeding experiments showed that the organism isolated manufactured in liquid cultures a very powerful toxin capable of setting up marked nervous symptoms in rabbits, guinea-pigs, dogs, and young buffaloes.

These experiments appear to show that the symptoms shown by the naturally affected calves, although resembling those of furious rabies in bovines, were not attributable to the rabies virus since they could be reproduced experimentally by the inoculation of a toxin contained in the brain of buffaloes, rabbits, or set up by means of a culture of the organism isolated from the brain. By its association with the rabies virus in milk-fed young buffaloes *B. bubalisepticus* appears to have undergone a great increase in virulence. The dams were more resistent as all contract "barbone" while young and this seems to confer a lifelong immunity.

REMLINGER (P.). **La rage spasmodique du cobaye.** [Spasmodic Rabies in the Guinea-Pig.]—*C. R. Soc. Biol.* 1917. June 16. Vol. 80. No. 12. pp. 590–592.

When the guinea-pig is inoculated with rabies virus into the anterior chamber of the eye it shows a special form of rabies which is interesting on account of the analogy of the symptoms with those produced in human rabies. Whether the eye remains intact or becomes shrunk up, as is very often the case even when the inoculation is carefully carried out, the disease commences with an intense local reaction in every way comparable with the reaction produced in the scars of bites in human beings. This reaction is manifested both by objective and subjective symptoms. Lachrymation occurs, the conjunctiva becomes congested and suppurates, the eyelids become red and swollen, and the lesions become the seat of an intense pruritus; the animal scratches them furiously with its paw or rubs its head on the same side as the inoculated eye against the walls of its cage. Almost at the same time the animal attracts attention by a sort of sonorous, coarse, thick gurgling noise comparable to the croaking guttural of certain frogs. It can be easily seen that this particular noise takes place in the pharynx and is connected with difficulty in swallowing set up by a spasm of this organ. The pharyngeal spasm appears to correspond exactly with the hydrophobic spasm in human rabies.

At the same time the animal presents a dejected appearance, erect hair, and dyspnoea. It remains motionless in its cage and if forced to move its gait betrays a certain degree of paresis.

Its condition soon becomes aggravated and violent convulsive crises are produced. These commence with the above described guttural noise; then instead of remaining localised the pharyngeal spasm becomes generalised throughout the body. The animal then bends itself round on the ground and emits feeble plaintive cries. After a few seconds it gets up on its feet and remains still until further convulsions are produced. A moderate sensory stimulus such as contact with water, sharp noise, sudden tapping, touching of the inoculated eye, etc., bring about instantaneously the reappearance of these symptoms. These crises finally become almost continuous until the animal is unable to get up and respiration gradually ceases. The total duration of visible disease rarely exceeds 48 hours, and is never longer than three or four days.

The author proposes to designate this particular form of rabies under the name of "spasmodic rabies."

Remlinger (P.). **Le virus rabique dans ses passages de cobaye à cobaye.** [Changes Undergone by the Rabies Virus in the Course of Transmission from Guinea-Pig to Guinea-Pig.]—*C. R. Soc. Biol.* 1917. June 30. Vol. 80. No. 13. pp. 628–630.

The rabies virus attains its maximum virulence more quickly in guinea-pigs than in rabbits; after a small number of passages—seven or eight—one obtains a virus capable of producing rabies symptoms after five or six days and which, when inoculated into the dog, exceeds in virulence the natural disease in that animal.

The symptomatology of rabies in the guinea-pig is liable to vary according to a number of factors, the chief of which are the seat of inoculation, age of the animal, nature and dose of virus. Other things being equal the first intracranial passages, starting from the dog's medulla, set up most often the paralytic form of rabies.

After a very small number of passages (one to four) it is on the contrary the furious form which is seen in its most exalted form. The guinea-pig stands with hairs erect, blows hard, has a fiery look, runs about its cage biting the other occupants, passes its head through the grating at the risk of choking itself, "chuckling," scattering its food about, etc. Soon the animal becomes still more agitated, shows great genital excitement, falls on its side, then gets up, and goes on again but soon it tires itself out and assumes a staggering gait. Finally, it remains stretched out affected with intense dyspnoea, gives a few sudden jerks with its limbs and body, but these become gradually weaker, while respiratory movements gradually cease. Death then very soon supervenes.

If the inoculation is made in the anterior chamber of the eye the "spasmodic rabies" is produced characterised by an intense reaction both objective (congestion, lachrymation) and subjective (pruritus) at the point of inoculation, pharyngeal gurglings, and spasms and more or less violent convulsive crises. . . .

However, from the seventh to the fifteenth passage the acuteness of the symptoms becomes lessened and the course of the disease can no longer be termed furious. There is no restlessness and the chief symptom is dyspnoea, the symptomatology closely resembling that of the numerous pulmonary affections which very often occur in guinea-pigs. At other times even dyspnoea is very slight and the guinea-pig is found in the morning dejected and lying still in a corner of its cage with erect hair, no appetite, and regardless of its surroundings. In the evening it lies on its side, tossing its body and limbs, and soon succumbs; the symptoms are more analogous to those of a septicaemia than of a broncho-pneumonia.

At the same time the length of the incubation period and of the visible disease is so shortened that death occurs very regularly from the fifth to the seventh day. Sometimes even it is produced so rapidly during the night of the fifth or sixth day or during the course of the fifth day that it appears to have taken place suddenly, as there was no time to observe any marked symptom. These are the so-called fulminating forms of rabies; no lesion is shown in the organs, cultures from the blood and viscera remain sterile, and a positive result is only obtained by passages. In the course of experiments with rabies every guinea-pig which dies without characteristic symptoms, or is found dead with no symptom, should be held as suspicious. Negri bodies should be looked for and the medulla inoculated.

From about the twelfth to the twenty-fifth passage paralytic phenomena become superimposed on the above symptoms. In the course of the later passages they assume an increasing importance and then no matter how many times the virus is transmitted from guinea-pig to guinea-pig it is from the exclusively paralytic forms that the animals succumb. While the rabies following inoculation into the muscles of a limb commences generally with a paralysis involving contraction of the inoculated limb (tetanic type) the paralytic rabies observed as the result of passages through the brain and anterior chamber of the eye is of the flaccid type. This takes place nearly always on the sixth day, rarely on the fifth, and exceptionally on the seventh. Paralytic phenomena appear to be produced sooner when the original virus is obtained from a dog dead of paralytic rabies than of furious rabies. Large doses of virus and inoculation of young animals also predispose towards the paralytic forms.

SANI (Luigo). **Sul passaggio del virus rabido attraverso la mucosa oculo-congiuntivale sana e traumatizzata.** [The Passage of Rabies Virus through the Healthy and Injured Oculo-Conjunctival Mucous Membrane.]—*Ann. d'Igiene.* 1917. Jan. 31. Vol. 27. No. 1. pp. 16–22.

The author's experiments, which were performed with fixed viruses for the rabbit and for the guinea-pig, showed that it was possible to reproduce rabies experimentally by passage of the virus through the oculo-conjunctival mucous membrane only when the virus had a markedly exalted virulence for the species of animal selected for experiment; the disease could in such cases be set up whether the mucous membrane was macroscopically healthy or contained recent artificially produced lesions. Cases of rabies are, however, rare even after instillation of an emulsion of an exalted virus into the conjunctival sac.

The instillation of virus that had not been exalted did not produce rabies. The author believes like former writers that the rarity of the cases thus produced is due not to a neutralisation of the virus in situ but to the abundant lachrymation immediately produced after the instillation.

According to his experiments the lesions present on the mucous membrane are of secondary importance in the production of experimental rabies. One must thus admit from these experiments that in the case of injury of the mucous membrane the minute quantities of virus that pass through become neutralised along the course of the ramifications of the nerve fibres.

FERMI (Claudio). **Il nuovo metodo italiano per la cura antirabbica.** [The New Italian Method of Anti-Rabic Treatment.]—*Ann. d'Igiene.* 1916. Vol. 26. Supplement. 164 pp.

The method of rabies vaccination evolved by Fermi at Sassari, Sardinia, is briefly as follows.

The vaccine consists of a 5 per cent. emulsion of a potent fixed virus, carbolised 1 per cent., direct from the rabbit or dog. The brain instead of the cord is used as the former was shown to be more active. The anti-rabic serum is obtained by hyperimmunising horses, using the above vaccine as antigen. The sero-vaccine consists of 1 part of serum and 2 of vaccine, carbolised 1 per cent. The method of treatment consists in the administration of sero-vaccine for the first 5 to 10 days followed by the injection of the vaccine alone up to the 25th day. The mortality from rabies following this treatment was calculated to be lower than that following treatment according to the methods employed by HÖGYES, BERNSTEIN, and REMLINGER. Advantages claimed for the vaccine and sero-vaccine are that they can be preserved for long periods sterile and potent in sealed tubes, can be transported over any distance for use, do not inconvenience the patient, and set up an immunity immediately in the case of severely bitten patients.

The new Italian method is stated to have been substituted in British India for a number of years for the Pasteur and Högyes methods on account of the superior results obtained.

MARTOGLIO (F.). **Sui corpuscoli speciali osservati da Braddon nel sangue di animali infetti di peste bovina e ritenuti probabilmente specifici.** [The Peculiar Bodies observed by Braddon in the Blood of Animals infected with Rinderpest and claimed to be probably Specific.]—*Ann. d'Igiene.* 1917. Apr. 30. Vol. 27. No. 4. pp. 246–250.

In 1913 BRADDON published a paper in which he maintained that by the addition of a solution containing 1 per cent. potassium citrate and 0·5 per cent. methylene blue in different proportions to rinderpest-infected blood peculiar slender bodies of varying shapes could be always demonstrated within the red corpuscles [see this *Bulletin*, Vol. 2, No. 1, pp. 45–47]. Martoglio had at his disposal a number of bovines affected with rinderpest at the Serum Institute at Eritrea and experiments were carried out using the technique recommended by BRADDON in order to ascertain whether the above bodies could be detected.

It was found that out of 30 bovines affected with rinderpest, blood taken three days after the onset of fever or six days after infection presented none of the forms claimed to have been rendered visible by BRADDON in all cases of the disease under the form of granules and filaments in the interior of the red corpuscles and with sharp or rounded extremities, etc. It thus seemed that BRADDON'S bodies had no connection with the rinderpest virus. The filamentous forms which he observed in fresh preparations did not appear to represent a morphological stage of the virus since they were revealed in the blood of healthy bovines afterwards shown to be perfectly susceptible and also in the blood of an animal not receptive, and in a horse. The author believes that the bodies represent degenerative changes in the corpuscles brought about by the treatment to which they are subjected.

GINS (H. A.). **Ueber experimentelle Vaccine und Vaccineimmunität.** [Experimental Vaccinia and Vaccinia Immunity].—*Zeitschr. f. Hyg. u. Infektionskr.* 1916. Aug. 18. Vol. 82. No. 1. pp. 89–142. With 2 tables.

This paper is an account of work, undertaken by order of the German Minister of the Interior, on the question of cow-pox immunity and a full discussion of the work already done on the subject is included. The animals used for the experiments were exclusively rabbits, as these animals were found to be most convenient and furnished the best results. In all 173 rabbits were inoculated with virulent material, for the most part by scarification of the cornea and some also by scarification of the skin.

The following are the author's conclusions :—

"The spontaneous appearance of vaccine pustules was never observed in rabbits and therefore the single pustules which always result could be dealt with experimentally.

"Rabbits inoculated with virulent material over a large skin surface always showed swelling of the precrural lymphatic glands and almost always enlargement of the spleen.

"Experiments performed in order to bring about multiplication of the vaccine virus on the ordinary artificial media always ended in failure.

"An infected cornea, cultivated in plasma according to the Harrison-Carrel method preserved the virus remarkably well. The newly formed tissue in the plasma showed cell inclusions which were not distinguishable from vaccinia corpuscles.

"Bacteriological tests of a considerable number of glycerinated lymphs never revealed the presence of pathogenic bacteria. The number of organisms diminishes so rapidly by preserving in glycerin that only a very few single germs gain access to the scarification marks in the vaccination of children.

"The cornea of the rabbit does not hold a special position of its own with regard to vaccine immunity. The cornea takes part in the general immunity to a slight degree whether the rabbit is inoculated into the skin or whether the rabbit is immunised by intravenous injection. A marked infection of the cornea can lead to immunity throughout the whole body.

"The immunity of the cornea follows considerably later than that of the skin after cutaneous or intravenous inoculation.

"Vaccine immunity in the rabbit is not a pure histogenic immunity as van Prowazek regarded it. The blood stream must be regarded as carrier of the immune bodies.

"The anti-virulent substances described by earlier workers are specific reaction products following on vaccine infection. They appear so regularly and abundantly and are durable for so long a period after infection that they must be held to demonstrate an acquired active immunity."

GINS (H. A.) & WEBER (R.). **Ueber den Nachweis des in die Blutbahn eingespritzten Vaccinevirus in inneren Organen bei Kaninchen.** [The Fate of Cow-Pox Virus injected into the Blood Stream in the Internal Organs of the Rabbit.]—*Zeitschr. f. Hyg. u. Infektionskr.* 1916. Aug. 18. Vol. 82. No. 1. pp. 143–154. With 2 tables.

Conclusions :—"With regard to the presumed fate of the vaccine virus injected intravenously the following conclusions are laid down as the result of our experiments :—

"The fact that the virus disappears very quickly from the blood stream was also confirmed in all our tests.

"By means of the test of Calmette and Guerin the virus can be demonstrated in the skin in very small quantities and by no means constantly." (This test consists in injecting a rabbit intravenously with virus ; if the skin is shaved at any time up to 24 hours after injection pustules appear on the shaved area.)

"This virus owes its survival apparently to the fact that it gained access into the blood vessels of the skin immediately after inoculation and thereby escaped rapid destruction in the animal body.

"After intravenous injection of large quantities of virus the virus can be demonstrated in the spleen in varying large quantities if this organ is used for inoculation within the first five hours after the injection.

"The virus was never demonstrable in the bone marrow ; and, in the liver it was found once only in small quantities after the injection of 50 c.c. of lymph diluted 20 times and once in considerable quantity in an animal after excision of the spleen.

"The spleen of rabbits inoculated into the skin was found to contain virus in only one case."

MARTEL (H.). **Rapport sur les opérations du Service Vétérinaire Sanitaire de Paris et du Département de la Seine pendant l'Année 1915.** pp. 146. 1916. Paris: Grande Imprimerie "Le Papier." [Myocardite aphteuse. (Myocarditis and Foot-and-Mouth Disease.)] p. 146.

"In the course of outbreaks of foot-and-mouth disease cases of sudden death observed among cattle are generally attributed to an acute form of the disease affecting the nervous system. Examination of a carcase in 1915, during the January outbreak, shows that death may occur otherwise.

"A cow in good condition was slaughtered. There were pronounced foot-and-mouth disease lesions in the process of healing on the tongue, ulcers of the same nature around and between the claws of the hind legs, and complicated ulcers due to infection with soiled litter.

"The infection of the sores on the hind legs manifested itself by a marked reticular lymphangitis of the fetlocks and by an inflammation of the lymphatic vessels extending upwards to the external iliac glands, which were swollen and haemorrhagic. The heart, which was not enlarged, presented an abnormal colour showing an irregularly marbled appearance due to light interposed areas. On incision the heart wall was found to be the seat of an intense myocarditis. Several soft haemorrhagic centres were distributed throughout the tissue in such a way that the myocardium might become perforated at any moment, with fatal results."

COSCO (Giuseppe) & AGUZZI (Angelo). **Sulla virulenza del sangue dei bovini aftosi e prove d'immunizzazione contro l'afta epizootica.** [The Virulence of the Blood of Bovines affected with Foot-and-Mouth Disease and Experiments on Immunisation against this Disease.]—*Direzione Generale della Sanità Pubblica.* 12 pp. 1917. Roma: Stabilimento tipografico Innocenzo Artero.

This pamphlet is issued by the Italian Public Health Administration by whose direction a series of experiments are being conducted by various workers under the control of a special Commission.

In a previous note Cosco and Aguzzi referred briefly to the results of their experiments which demonstrated in particular the virulence of the blood during the febrile period in foot-and-mouth disease [see this *Bulletin*, Vol. 4, No. 2, pp. 62].

After natural or artificial infection a rise of temperature follows after a period of incubation varying with the mode of infection and virulence of the infective material. If highly virulent material from fresh lesions is rubbed on to the scarified buccal mucous membrane the incubation period may be limited to 24 hours or even less; ordinarily it is from two to five days. After subcutaneous inoculation with highly virulent red corpuscles (2nd or 3rd passage) the incubation period lasts about 70 hours, but never less, while with corpuscles of lesser virulence it lasts on an average from five to nine days; inoculation with virulent blood serum gives practically the same results.

The fever is of the remittent type and is preceded for about an hour by other symptoms, such as rigors and loss of appetite. The rise in temperature then reaches about 2° C. The febrile crises follow each other every 24 hours with great regularity and in the intervals the temperature may drop from 1° to 2° C.

Eruptions rarely occur during the first crisis; they are usually observed during the second and not rarely during the third or even the fourth crisis. In the more severe forms, especially after inoculation by scarification, the eruptions appear sooner while on the other hand following inoculation with virulent red corpuscles it is not rare to observe even the initial eruptions during the fourth febrile crisis. In all cases the eruptions do not occur simultaneously, that is, they do not all develop during a single crisis.

In the majority of cases the red corpuscles were found to possess their maximum virulence at the beginning of the second and third crisis, and to become less virulent during the ascent of the febrile curve; the virulence diminishes at the height, and disappears completely or almost completely during the descent of the curve. The serum on the other hand appears to attain its maximum virulence during the height of the crisis and unlike the corpuscles never appears to lose its virulence completely.

Experiments performed in order to determine the virulence of the red corpuscles and of the serum showed that with equal doses the latter is always more powerful. It might appear that the corpuscles owe their virulence to a small quantity of serum remaining cemented to their bodies after centrifugation,—but, (1) if the corpuscles are washed by repeated centrifugation their virulence remains unchanged, (2) it is impossible to produce the disease by the inoculation of less than ¼ c.c. of serum, (3) if the corpuscles and the serum are kept separately in an ice chest the virulence of the serum disappears several days before that of the corpuscles; the serum becomes inactive after remaining in these conditions for 24 days while the corpuscles were shown to be virulent even after 32 days.

With regard to minimum doses required to produce the disease by subcutaneous inoculation, repeated tests showed that in the case of the corpuscles obtained from blood extracted at a favourable moment during the development of the fever in cattle affected with the natural disease the dose, shown to be the optimum, was 10 c.c. When an outbreak has assumed a serious character one can, however, obtain blood containing corpuscles capable of producing the disease in much smaller doses. In the case of an exalted virus obtained by passages through the bodies of susceptible animals it is not difficult to set up the disease by the inoculation of 1 c.c. of corpuscles. The serum when extracted from the blood at a favourable moment during the febrile curve is capable of setting up the disease with a minimum dose of $\frac{1}{4}$ c.c.

Bovines were used exclusively in connection with experiments for the exaltation of the virus. Passage through swine gives rather better results but as the experiments were performed with the object of providing material for the immunisation of cattle the use of heterologous products presented disadvantages. Commencing with the inoculation of 10 c.c., subcutaneously, of corpuscles from a bovine infected by scarification it was found possible to increase the virulence in the course of six passages so that (1) finally, severe foot-and-mouth disease was set up by the inoculation of 1 c.c., (2) by continuing to inject a constant dose of 10 c.c. a more severe form of the disease was set up each time than in the preceding passage until at last the animals died from the apoplectic form, and (3) the incubation period became shortened from an average of 6 days to 70 hours.

The administration by ingestion of large quantities of infective material such as the products from the vesicles in the mouth and blood (40 c.c. corpuscles and 20 c.c. serum) invariably gave negative results.

Intravenous inoculation gave the following results, care being taken to prevent the escape of material subcutaneously:—(1) In the case of the serum small quantities—$\frac{1}{4}$ c.c.—constantly set up foot-and-mouth disease in the same way as subcutaneous inoculation; (2) the inoculation of red corpuscles even in such a high dose as 35 c.c. never set up the visible disease, whereas 10 c.c. of the same corpuscles inoculated subcutaneously into controls set up symptoms similar to those manifested in the animals from which the blood was originally obtained.

Immunisation tests.—While occupied in controlling the method of immunisation proposed by Terni [see this *Bulletin*, Vol. 4, No. 4, pp. 173], the authors made use of the materials at their disposal in an attempt to discover a vaccine against foot-and-mouth disease. Several experiments were performed, chiefly in the direction of preparing a sensitised vaccine according to Besredka's method; material from the buccal lesions was thus collected and subjected to the action of serum from immune bovines. The material obtained became always so badly contaminated that it was impossible to produce an effective vaccine in this way.

The red corpuscles, however, inasmuch as they could be withdrawn aseptically and possessed a slight virulence, which had hitherto escaped the notice of other authors, proved invaluable for experiments on immunisation. Attempts to sensitise the virus contained in them by Besredka's method proved unsuccessful as no satisfactory method could be devised for keeping the corpuscles intact. The method of vaccination thus consisted in setting up an active immunity by the intravenous injection of virulent corpuscles.

The material necessary for vaccination was not difficult to prepare, easily preserved, and easily administered in practice. As shown above large doses of virulent corpuscles can be inoculated intravenously without setting up external manifestations, but the injection determines a general reaction represented by a rise of temperature which is manifested almost immediately after inoculation, lasts about 24 hours, and reaches about 2° C. above normal; this is accompanied by other symptoms such as depression, increase in respiration, inappetence, and slight disturbance in connection with the gastro-intestinal tract. Animals thus inoculated intravenously were subsequently inoculated subcutaneously with virulent corpuscles, simultaneously with a number of controls, which each received 10 c.c. of the corpuscles, of the same breed and condition. Sixteen cattle vaccinated by means of a single intravenous inoculation were exposed at various intervals during six months to natural infection, and, with the exception of one case, none of these animals developed lesions, whereas all the controls became affected.

The authors conclude that washed corpuscles after intravenous inoculation are capable of setting up a slight general reaction without external lesions and that this initial injection, according to their preliminary experiments, is capable of setting up an immunity which lasts at least two months.

[A very full extract is given above on account of the high administrative authority under which the note is published; the results, however, appear to be so widely different from those of other observers that they must necessarily be read with reserve until the authors issue for criticism full details of their experiments.—Ed.]

MISCELLANEOUS.

(a) Contagious Pustular Stomatitis.

de Jong (D. A). **Le rapport entre le stomatite pustuleuse contagieuse du cheval, la variole équine (Horse-Pox de Jenner) et la vaccine (Cow-Pox de Jenner).** [The Relationship between Equine Contagious Pustular Stomatitis, Equine Variola (Jenner's Horse Pox) and Vaccinia (Jenner's Cow Pox).]—*Folia Microbiologica.* 1916. Nov. 1. Vol. 4. No. 3. pp. 239–266. With 5 plates comprising 14 figs.

This article opens with a very complete and critical review of the equine affections described variously under one or other of the above names from the time when Jenner (1800) attributed the origin of cow-pox to an affection involving the heels of horses and described simply by him under the name of "grease." Although the disease has been recognised to have been of comparatively common occurrence in England and its occurrence on the Continent often attributed to the importation of English horses very little has been written about it in this country since the time of Jenner. In France, on the other hand, the disease has engaged the attention of various observers and, according to Nocard and Leclainche, Bouley (1860) would be the first to suggest the name "horse-pox" for outbreaks of a pustular nature among equines. Since CHAUVEAU's work on variola (1886) it has been held in France that the equine variola, which had been considered up to then as a so-called spontaneous disease, could manifest itself under the form of a vesiculo-pustular eruption not only on the limbs but also on several other parts of the skin and even on the mucous membranes.

In Germany, on the other hand, even comparatively modern authors (EGGELING and ELLENBERGER, FRIEDBERGER, and DICKERHOFF), considered equine variola either as a rare disease or even denied its existence; they maintain, however, that there is a commonly occurring affection of horses known as "contagious pustular stomatitis" to which French authors had given, wrongly according to them, the name of "horse-pox" A so-called "contagious acne" of horses is likewise recognised.

In Holland outbreaks of cow-pox have been definitely known to occur at intervals for over a century, and, according to the author, the disease known as "contagious pustular stomatitis" of the horse is well known to Dutch veterinary surgeons although no accurate figures can be given.

Soon after the mobilisation of the Dutch army at the commencement of the present European war outbreaks of pustular stomatitis occurred in various garrisons stationed near The Hague. Diagnosis was quite easy. Besides stomatitis there were often seen pustules on the skin of the head and other parts of the body as well as at the extremities of the limbs.

The following are briefly the symptoms manifested in one outbreak affecting 300 requisitioned horses. The first symptom consisted in marked salivation, especially during feeding, but the appetite was not diminished although the horses ate with difficulty. A multitude of small papules are found at this stage on the mucous membrane of the lips, especially the upper lip, occupying the site of the follicles; there is a small amount of fever, then small vesicles filled with a clear liquid appear, especially on the upper lip, occupying the sites of gland follicles. The submaxillary lymphatic glands may then become congested.

The second stage is seen in one or two days. The contents of the vesicles become turbid giving rise to pustules. The epithelium is then shed leaving small cavities from the size of a large pin's head to that of a small pea. These small ulcers often become confluent and give rise to irregularly-shaped excavations. These changes are seen on the insides of the lips, on the gums above the incisor teeth, and on the tongue. The lesions cause very excessive salivation and often a foetid odour from the mouth and swelling of the lips. The excoriations then heal and in about 10 days every trace of eruption has disappeared from the lips. The tongue lesions heal rather more slowly.

In some animals besides eruptions there are seen swellings on the skin. Two horses showed a large number of papules on the neck, shoulders, chest and fore legs. One of these animals presented during this second stage a cutaneous eruption in the form of local thickenings on the chest and fore legs; these burst, became confluent and formed a sort of granulating surface. Four horses showed a continuous inflammation in the hollow of the heels of the fore and hind limbs. The swellings were first observed, then the hairs became moist and finally the heel became scabby. Under the scabs were found small rounded granulating ulcers similar to those found on the lip but not confluent. No lesions were found on the mucous membranes other than those of the mouth.

The period of incubation may last from four to six days, the virulence is greatest at the commencement of an outbreak, and it was at this period that the largest number of cutaneous eruptions were observed. Later on, these eruptions became rarer, and also the excoriations on the tongue. Even the eruptions on the skin and mucous membrane of the lips became less serious and one might observe sometimes healing by absorption without rupture of the pustules. Transmission of the disease by means of the saliva appears to be most frequent.

The diagnosis is easy although at the beginning one may be dealing with normal or diseased follicles. However, the glandular congestion and the contagious nature of the disease prevent error.

Treatment shows no difficulty as the affected animals recover spontaneously.

Experimental.—In this connection the author performed numerous experiments on the transmission of contagious pustular stomatitis of horses to healthy horses and also to calves, rabbits, and children, both with fresh exudate and exudate after filtration through a porcelain filter. Some transmission experiments with cow-pox lymph were also made. The following are the author's own conclusions:—

"(1) In the cases observed of contagious pustular stomatitis of the horse an eruption was found in the mouth and on the skin.

"(2) The material collected from the mouth of affected animals was capable of transmitting experimentally the disease including the cutaneous eruptions.

"(3) The same material passed through Chamberland B. and F. filters retained the same infectivity.

"(4) Vaccinia cultivated in the ordinary manner was equally capable of producing in the horse the pustular stomatitis including the cutaneous eruptions.

"*The horse which had contracted spontaneously the stomatitis was refractory to inoculation with vaccinia.*

"(5) Two different strains of virus of contagious pustular stomatitis of the horse behaved like vaccinia in the course of inoculations into the calf and the rabbit; in the latter animal also the corpuscles of Guarnieri were obtained in the inoculated cornea. Besides, the deviation of the complement test furnished still further corroborative proof of this contention.

"(6) The vaccine obtained by inoculation of virus of contagious pustular stomatitis of the horse could be cultivated regularly on animals as easily as the ordinary vaccine. This vaccine of equine origin gave excellent vaccinal pustules in the case of children inoculated with it.

"*The re-vaccinated children showed only a re-vaccination reaction.*

"(7) Rabbits inoculated with ordinary vaccinia and which had shown a strongly positive reaction, after recovery and re-vaccination with the stomatitis virus, manifested only an early allergic reaction (von Pirquet); on the other hand controls showed a characteristic eruption.

"(8) We have proved that the contagious pustular stomatitis of the horse is actually the most common form of Jenner's horse-pox and that the virus of this stomatitis passes through Chamberland B. and F. candles. This fact was hitherto unknown."

GREGG (James). **Vesicular Stomatitis Contagiosa.**—*Vet. Record.* 1917. Mar. 17. Vol. 29. No. 1497. pp. 381–382.

This preliminary note deals with the occurrence and etiology of a disease affecting horses and mules at the British Remount Depot, Newport News, Virginia, U.S.A.

The clinical nature of the disease is passed over briefly. It is merely stated that the mouth lesions resembled those of foot-and-mouth disease, but that there were no lesions about the feet. 85 per cent. of horses, 75 per cent. of large mules, and 25 per cent. of small mules became affected in the scene of an outbreak. "The period of incubation averages three days, starting with an inflamed mouth, then in a short time the formation of vesicles on the sides and point of the tongue, and sometimes on the lips—these break almost immediately, leaving red inflamed surfaces. Constitutional disturbance is slight. Period of attack averages one week. Animals usually eat a little, but fall off considerably in condition."

The bacteriologist (GREGORY G.) of the Depot isolated from the pustules a staphylococcus growing slowly and meagrely on ordinary laboratory media and producing no harmful effects after intraperitoneal inoculation into the rabbit or guinea-pig.

Some transmission experiments were attempted with sub-cultures of this organism. An emulsion rubbed on the tongue and lips of four mules gave negative results after four days, but inflammation of the mouth and mild salivation was observed in three of them on the sixth day. Intravenous inoculation of the organism produced in one mule after 48 hours cording of the veins and lymphatics under the tongue and inflammation of the buccal mucous membrane, copious salivation, and a rise of temperature of 1° F. Inoculation of large doses under the mucous membrane of the tongue produced, in two mules, at the seats of injection after 24 hours, pronounced nodules, and then vesicles in from 48 to 72 hours. The coccus was recovered from these vesicles.

[The author apparently feels justified in heading this brief record of transmission experiments with the words, "A mild form of the disease produced." His experiments are, however, most inconclusive and hastily published. The clinical history of the natural disease is but briefly discussed, but it may be inferred that *multiple* vesicles were found on the lips and buccal mucous membrane and that the disease was extremely contagious. Neither of these conditions were fulfilled in the experiments with the organism described. The author would be well advised to consult the article published recently by DE JONG on what is most probably an identical disease (see above extract).—ED.]

GREGG (James), McGUIRE (F. X.), GLOVER (G. J.), GILLESPIE (A.) & GREGORY (G.). **Vesicular Stomatitis Contagiosa.**—*Amer. Jl. Vet. Med.* 1917. April. Vol. 12. No. 4. pp. 221–222.

This article is almost entirely identical with that published by Gregg alone (see above) with the exception that another series of experiments in connection with the organisms isolated from the lesions are described.

"The organisms isolated from the inoculated animals were injected into the tongues of two mules, with negative results.

"The original cultures were used on two horses and three mules as follows :—

"(1) A seven-year-old bay gelding had four cc.'s of a heavy suspension injected per jugular with negative result.

"(2) A nine-year-old black gelding had four cc.'s injected under the tongue ; result was mild inflammation of the mouth on the third day, which disappeared rapidly.

"(3) A black mule gelding had four cc.'s intravenously with negative result.

"(4) A black mule had four cc.'s injected into the tongue, results were mild inflammation of the mouth on the third and fourth day.

"(5) A grey mule gelding had four cc.'s injected into the tongue. Animal showed active inflammation of the mouth with salivation on the fourth and fifth day."

The authors then add a note stating that at the time of writing the disease had disappeared entirely from their pens and hospitals—" in fact, it went out as suddenly as it came in." The disease is stated to have lasted four months and produced several thousand cases. The symptoms are described a little more fully and they correspond with the descriptions given elsewhere. In this paper the reader is asked to draw his own conclusions from the results of the experiments.

MORI (Nello). **Sul germe specifico della Stomatite pustolosa contagiosa degli equini e Afta di Regis.** [The Causal Organism of Contagious Pustular Stomatitis in Equines or King's Aphtha.]—*Clinica Vet.* 1917. July 15. Vol. 40. No. 13. pp. 381–383.

In 1909 the author studied the above disease in a number of Hungarian remounts imported into Italy. He came to the conclusion that the disease was a pathological entity and not a form of horse-pox as the majority of French, English, and Italian authors maintain. Pure cultures of an organism which he maintains to be similar to that described recently by GREGG (see above) were isolated from the vesicles.

EICHHORN (Adolph). **Vesicular Stomatitis in Cattle.**—*Amer. Jl. Vet. Med.* 1917. Mar. Vol. 12. No. 3. pp. 162 & 170.

The United States Bureau of Animal Industry received rather alarming reports from Kansas and neighbouring parts that a disease existed among the livestock, particularly among cattle and horses, closely resembling foot-and-mouth disease. On arrival at the scene of the outbreak Eichhorn observed that the buccal lesions resembled those of foot-and-mouth disease so closely that a differentiation was almost impossible. In early cases typical vesicular formations with an accumulation of lymph were found. These vesicles ruptured readily, leaving a surface similar to that seen in foot-and-mouth disease. The lesions were not confined to any part of the mouth, the tongue was affected in about 50 per cent. of the cases, the dental pad was rather more frequently affected ; the other parts of the buccal mucous membrane showed lesions varying in frequency. The regenerative process progressed very rapidly, the only difference from foot-and-mouth disease being that in some cases the eroded parts were covered with a thick gelatinous pseudo-membrane.

Inoculation tests.—Three calves were inoculated by scarification and five others, kept in another isolated pen, were inoculated intravenously with material from the lesions. The scarified calves developed lesions on the dental pad in 48 hours but these were not quite typical in appearance. The calves inoculated intravenously remained unaffected. Interdigital inoculation of five pigs gave negative results. Likewise horses inoculated by rubbing infected material on the tongue showed no lesions on the third day and so the tongue was re-inoculated by scarification. "One of the horses on the third day developed a vesicle on the dorsum of the tongue and, as in the successful transmission to horses in Washington, on the following day an expansion of the disease was observed affecting almost the entire surface of the tongue."

The disease differed from foot-and-mouth disease in the following respects :—(1) the transmissibility of the disease to horses from cattle and the failure to infect pigs, (2) the absence of foot lesions in infected and exposed cattle, (3) the appearance of newly-formed vesicles after the commencement of the healing process in some cases, (4) the immunity of a large proportion (up to 60 per cent.) of exposed animals in some centres, and (5) the temperature was not observed to rise over 103° F.

JOHNSON (P. E.). "**Infectious Stomatitis.**"—*Jl. Amer. Vet. Med. Assoc.* 1917. Mar. Vol. 50. (New Ser. Vol. 3.) No. 7. pp. 882–883.

In this short article the author describes a recent outbreak of stomatitis affecting about 1,000 head of horses and cattle in South Dakota, U.S.A.

In other parts of the United States it has been recognised that this disease may take on either a very mild or a severe course. The disease was introduced into South Dakota by means of five horses which had been exposed to infection in Sioux City. One of these horses showed symptoms on the day after arrival and on the following day similar symptoms were noticed in several other horses. These animals were placed under quarantine as an inspector had noticed the disease in several of the cows and among some of the horses in the yard. "On the same day, immediately preceding the quarantine, and also on the two previous days, there were thirty-five different ranchmen from various parts of the country, that had stabled and fed their teams and saddle horses in the barn and were thus exposed but had removed their horses before the quarantine was placed on the barn. From ninety to ninety-five per cent. of the exposed animals developed the disease. Among the first animals exposed it spread more rapidly than it did later and the disease was more severe in the animals first affected in a herd than in those it developed in later."

"The disease develops in from three to five days after exposure, and it is recognised by the animals refusing to eat and showing a good deal of slobbering. They generally have a rise of temperature of from two to three degrees, and also show some lassitude. The lesions are found mostly on the lips and on the dental pad of the cattle, and on the tongue and sides of the mouth in the horse. In some of the horses the whole upper surface of the tongue was entirely raw, and there was an odor of necrosis, especially in the neglected cases."

The most common method of infection is through eating hay soiled with the saliva of infected animals. The period over which an animal will spread the infection is probably not over one week. The disease causes practically no mortality among stock but the animals are left in a run-down condition from the attack. Treatment consisted in quarantining the exposed stock, separating the infected from the non-infected, and washing the mouths of infected animals with a solution of potassium permanganate once daily. In very severe cases the lesions were curetted and tincture of iodine applied once.

PANISSET (L.). **À propos de la stomatite vésiculeuse du cheval (stomatite ulcéreuse, stomatite érosive).** [Vesicular, Ulcerative, or Erosive Stomatitis in the Horse.]—*Rev. Gén. Méd. Vét.* 1917. May 15. Vol. 26. No. 305. pp. 181–183.

" The vesicular stomatitis observed among horses at the front by some observers and summarily described since 1915 as a new disease has, in the course of the last few months, spread considerably, but not alarmingly as the disease has so far shown no malignant tendencies. The veterinary hospitals especially and numerous units which have received horses from centres primarily affected have suffered considerably from the disease."

The author proceeds to show that this disease was most probably imported into France from America by means of infected remounts. The U.S.A. Bureau of Animal Industry during the latter months of 1916 investigated the disease affecting a very high proportion of remount concentration depots at Chicago, Nebraska, and Colorado. The disease was also seen in America to spread to the ox, but the pig and sheep remained refractory, hence the non-identity of the affection with foot-and-mouth disease. The Bureau, moreover, observed that the disease transmitted by inoculation possessed a longer period of incubation at each new passage. Transmission experiments with filtered products failed.

BURTON (A. C.). **"Stomatitis Contagiosa" in Horses.**—*Vet. Jl.* 1917. July. Vol. 73. No. 7. pp. 234–242. With 4 figs.

This author furnishes a good clinical record of the above disease as it occurs among British army horses in France. The number of outbreaks and cases dealt with is unfortunately omitted.

The disease is defined as " a contagious disease characterised by vesicular eruptions in the mouth with subsequent more serious and characteristic lesions therein; similar lesions on m.m. of oesophagus and stomach, with an acute gastro-enteritis; occasionally, also, an eczematous coronitis." It is stated that the condition is different from the disease described by FRIEDBERGER and FROHNER as " stomatitis contagiosa pustulosa." Horses readily contract the disease; mules are not so susceptible, but are by no means immune. It is transmissible to man; the author himself and two of his assistants contracted it. The disease was of short duration, of a mild character although very painful, and confined to the mouth, the lesions being similar to those described in the case of the horse. The disease is readily amenable to treatment with the aid of mild antiseptics.

The period of incubation is said to be short, 24 hours to three days. The immunity conveyed by one attack appears to be of short duration; re-infection took place in less than two months. All classes and ages of horses are affected to the same degree.

The initial symptom is an inflamed condition of the mucous membrane of the mouth or lips speedily followed by the formation of vesicles. On the lips the vesicles are most common at the junction of the skin and mucous membrane, and are usually discrete and rupture quickly. "A crusty eczematous appearance" is then produced. A few vesicles may appear on the skin itself. Similar vesicles are found within the lips and on the gums and have a tendency to coalesce before bursting. Vesicles are also quite common on the upper and lower palate, especially on the bars, and on the mucous membrane of the cheeks, but they are usually not so severe in these places. The most serious buccal lesion is found on the tongue where the vesicles coalesce over a large area, forming subsequently large eroded patches. Salivation varies in amount, and may not be present at all. It may be said to take place only where tongue lesions exist. In severe cases the odour from the mouth is very offensive, resembling that from the breath of an animal suffering from gangrenous pneumonia. Colic is a frequent symptom, more especially in cases running an unfavourable course. The pulse assumes a rapidly falling character; the visible mucous membranes are highly congested. Fever is present only in very severe cases and in cases complicated with abdominal lesions; the temperature may then reach 103° to 104° F. The appetite remains good where the mouth lesions are not severe but severe lesions prevent feeding and an animal thus affected wastes rapidly. Healing takes place in from a fortnight to two or three months but complications affecting the digestive tract may set in when recovery is apparently complete.

The foot lesions are described as "an eczematous coronitis." The affection is seen in one or more feet, is very painful, and develops rapidly. Acute lameness may set in suddenly, vesicles appear almost immediately, rupture, and a straw-coloured exudate trickles down the wall of the hoof. The heel is the part most often primarily affected and thence the lesions often spread rapidly all round the coronet. The coagulated serum forms a thick crust over the part. These lesions are generally observed at the same time as the mouth lesions.

According to the author the disease often runs "an unfavourable and even fatal course."

On post-mortem examination one finds mouth lesions of varying severity, marked emaciation, although the stomach and intestines may be comparatively full of foodstuffs where the mouth lesions permit of normal feeding. Lesions as on the tongue and lips may be found on the mucous membrane of the oesophagus, also quite commonly in the stomach, especially at the junction of the villous and cuticular membranes, and they are found to vary in age and severity. In such cases an acute gastro-enteritis is invariably found. No characteristic lesion is, however, found in the intestine.

Local treatment by means of antiseptics such as potassium permanganate, potassium chlorate, and copper sulphate appear to have a very beneficial effect. The mode of treatment employed by the author consists in placing all the more seriously affected animals side by side in a stable. Three or four times a day the horses' mouths are washed out with a solution of potassium permanganate (½ oz. to 5 gallons cold water). This solution is carried on the back of a dresser who inserts the nozzle of the sprayer, covered with a piece of rubber hosepipe perforated with a series of small holes, carefully into the mouth of each horse as he passes along in front of the horses. The treatment is apparently not resented by the horses.

GIBBS (H. E.) & POOK (G. G.). **A Report upon an Outbreak of Stomatitis Contagiosa.**—*Vet. Jl.* 1917. May. Vol. 73. No. 5. pp. 147–155. With 4 text figs.

This paper contains some notes on the clinical appearance of the above disease together with brief accounts of two series of experiments. The disease is stated to differ from the " true Pustular Contagiosa, in so far as it is possibly more readily transmissible, certainly extremely benign, and has apparently no deleterious effects on animals suffering from it." [The authors' evidence for this statement is not given. It is not known whether a differentiation from the so-called " true Pustular Contagiosa " is made on account of their personal experience with that disease or from the descriptions given in the literature in connection with it. The article is neither well written nor well edited.]

The temperature was found in some cases to rise to 103° F. 24 hours before the vesicular eruption appeared and remains high for 48 hours. There is a profuse discharge of mucous saliva at the commencement of the disease ; this often becomes frothy later on. In the course of the outbreak animals were noticed with intense salivation and showing only congestion of the buccal mucous membrane, disappearing spontaneously a few days afterwards.

The lesions are found confined to the buccal mucous membrane, most commonly the tongue. They vary considerably in size, a single vesicle often measuring 1 inch in diameter ; a number of vesicles often coalesce to form one large bleb ; this bleb quickly ruptures, discharging a straw-coloured serous fluid, and leaves a raw congested surface to which a few hours afterwards a straw-coloured jelly-like substance is found adherent.

The disease was found to take from four to six weeks to run its course. Healing took place from both the periphery and the bottom of the lesions, in most cases leaving no trace of the disease. Large lip lesions often left behind them elongated scars.

The smaller lesions did not appear to affect the animals' ability to feed, but the larger ones caused difficulty in feeding and consequent loss of condition. The infection was most probably carried by the indirect method. Treatment consisted in feeding on soft food and the administration of antiseptics locally.

Experimental.—The period of incubation after inoculation of the the contents of the vesicles was found not to exceed 24 hours in the case of two horses, one of which was inoculated with the fluid underneath the mucous membrane of the tongue, while in the case of other horse the fluid was applied to the scarified tongue surface. No lesion followed the inoculation of fluid beneath the skin of the coronet.

When the mode of transmission was made to simulate the probable natural method of infection the results were very irregular. Ten horses and five mules were thus isolated and the saliva from the mouths of badly affected animals applied in various ways to their buccal mucous membranes, viz., by application of cotton-wool soaked in discharges, drinking from contaminated vessels, and ingestion of contaminated food, etc. Two of these horses were kept as controls. Typical lesions developed in seven of these horses in from 5 to 19 days. Two of these horses, however, were the controls, which became affected in 10 and 14 days, respectively. The lesions produced in the more retarded cases might thus not have been due to the original application of discharges. Three of the horses and all the mules did not become visibly affected.

In another similar series of experiments in which the same number of animals were used, one horse and three mules being kept as control animals, eight of the horses including the control became affected on the day following the experiment, and the ninth on the second day. The tenth horse developed no lesions. Three of the mules, including two controls, developed lesions on the first day, another control on the second day, and the remaining mule on the fifth day after the commencement of the experiment.

According to the authors' opinion, it is the vesicular contents which should be held responsible for the disease and the lesions lose their infectivity shortly after the rupture of the vesicles. In support of this statement they quote an experiment in which five susceptible horses were rubbed on the scarified surfaces of their tongues with a piece of cotton wool soaked on a serious lesion of four days' standing. No lesions were subsequently found in any of these horses on examination extending over a period of 14 days.

(b) CONTAGIOUS AGALAXY OF GOATS.

SERGENT (Edm.) & ROIG (G.). **Sur l'existence de l'agalaxie contagieuse des chèvres en Algérie, et sur une infection surajoutée.** [Contagious Agalaxy of Goats in Algeria and a Secondary Infection.]—*Bull. Soc. Path. Exot.* 1917. July. Vol. 10. No. 7. pp. 575–585. With 1 text fig. & 1 chart.

Conclusions:

"Contagious agalaxy of goats occurs in Algeria. We witnessed in 1908 an outbreak remarkable on account of its suddenness and its violence. In three months it killed off 124 out of 450 goats (27·5 per cent.), attacking especially the young animals.

"In the natural disease mammary lesions are constant, articular lesions frequent, while ocular lesions were not observed. Thus animals not producing milk only showed articular symptoms.

"In the experimental disease the mammary and articular lesions are constant. Ocular lesions were observed in 2 cases out of 13.

"Inoculation of blood of infected animals did not transmit the disease and produced no subsequent immunity.

"Inoculation of milk subcutaneously or intraperitoneally produces the disease with certainty in goats. Intraperitoneal inoculation does not infect the guinea-pig or the rat.

"The virus did not become attenuated by passages.

"Ingestion of infected milk did not produce the disease.

"One goat contracted the disease by cohabitation.

"In the outbreak studied a polymorphic organism belonging to the Preisz-Nocard group was constantly found in the milk, but not in the blood.

"The inoculation of cultures of this organism was not pathogenic.

"This organism is undoubtedly a concomitant parasite ("*temoin*") of the ultra-visible virus discovered by Celli and Dante de Blasi. It does not even seem to play the part filled by Carré's pyobacillus in 'mal de Lure.'

"It appears to be merely a secondary invader following the infection set up by the specific virus."

(c) ERADICATION OF LOCUSTS.

Velu (H.). **Deuxième campagne d'expérimentation de la méthode d'Hérelle au Maroc contre** *Schistocerca peregrina* **Olivier (mars-juillet 1916).** [Second Experimental Campaign for the Destruction of Locusts in Morocco by means of D'Hérelle's Method. March-July 1916.]—*Ann. Inst. Pasteur.* 1917. June. Vol. 31. No. 6. pp. 277–290.*

Conclusions:

"From facts observed during the 1915 campaign the following conclusions were drawn :—*There may exist among invading swarms of locusts outbreaks of contagious enteritis set up by a coccobacillus of the same group as D'Hérelle's bacillus.* The severity of these outbreaks is variable. *They prevent the exaltation of the virulence of D'Hérelle's coccobacillus maintained* in vitro.

"*The locusts which are born during the passage of contaminated swarms are infected by means of the dead bodies.*

"The coccobacillary enteritis of locusts is perhaps a more common disease in nature than is at present believed. The mortality observed in 1910 by Dr. D'Hérelle in America is probably common in Africa. This possibly accounts for the disappearance of swarms for several years, and for the long periodicity of the invasions.

"Schistocerca peregrina *Olivier is distinctly susceptible to infection by means of D'Hérelle's coccobacillus at all stages in its development,* but as contamination is brought about almost entirely by means of cannibalism the outbreaks set up are proportional in severity to the ease with which the diseased insects are devoured by their neighbours.

"The factors which tend to render the infestations more efficacious include all those which increase the density of the swarms of locusts and consequently favour cannibalism.

"*The most favourable time for spraying is at the end of the third stage.* The locusts are not then formed up in columns ; they form dense compact masses which move about very little. They are so close together that contamination of the pastures is certain and that the affected insects are devoured without fail as soon as they are too weak to protect themselves.

"*From the commencement of the fourth stage and onwards the propagation of the infection is much less certain.* Sprayings no longer have the same efficacity ; the density of the columns is less, the distance covered each day becomes gradually greater ; the dead bodies are spread out over a large area ; *the affected insects form behind the main column échelons of stragglers which die separated from the others and are thus useless for further propagation of the infection.* As one nears the time of the last moult, the columns of locusts become submitted to more and more strict sanitary rules which bring about the automatic elimination of disease carriers. The last stages of larval life are thus not favourable for the application of the biological method, *especially in open country.*

"The application fo D'Herelle's method demands a precision so difficult to obtain that one cannot with our present knowledge consider it as sufficient in itself to bring about wholly the solution of the important problem of eradicating locusts. But on the other hand one cannot dispute that its efficacity when applicable renders it distinctly superior to all other methods, and especially more economical. Without thinking of abandoning any of the other means of protection hitherto employed the greatest and most certain advantages should be taken of the biological method.

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* The subject matter of this paper has previously been dealt with briefly by the author in another paper [see this *Bulletin,* Vol. 5. No. 1. p. 56].

"As a very large number of larvae are never hatched at the same time but are hatched successively in the same region at times varying with the aspect and nature of the soil, a single body of men cannot carry out all the infection operations, especially if one admits that these infections must be made on the clusters of larvae before the formation of columns. It is thus indispensable to find out and infect all the masses of locusts before the tenth day. For this purpose one must thus provide an organisation for a district composed in the following manner: One veterinary surgeon belonging to the Department of Animal Industry, three mounted European "infectors" and three camelmen.

"The stocks of broth should be made up in each centre immediately on the arrival of the swarms and the virulent material should be prepared beforehand in the research laboratory of Casablanca.

"Finally, as it has been observed that the swarms just when entering the country showed a considerable mortality and infected the clusters of young locusts, it is best to infect the swarms directly on their arrival in the south, at Agadir, and even further if possible.

"Applied on a large scale the biological method must considerably diminish the damage done by the swarms of locusts as well as that done by the clusters of young locusts, and consequently facilitate in a large measure the mechanical means of combat and reduce the considerable expenditure which this involves." . . .

(d) CAMEL PURGATIVES.

CROSS (H. E.). **A Note on the Action of Purgatives on the Camel.**—6 pp. 1917. Lahore: Supt. Govt. Printing Punjab.

As the result of experiments in the administration of various quantities of the commonly used purgatives to the camel the author's experience led him to summarise his views as follows:—

"To produce purgation in the camel the following doses require to be given:—8 oz. kamala; 4 pints linseed oil; 3½ drachms of croton oil; 3½ ozs. aloes solution; 1½ to 2 lb. magnesium sulphate; 3 ozs. gamboge; 2 grains eserine and 2 grains pilocarpine given subcutaneously.

"Of the purgatives tried the best purgative for the camel is magnesium sulphate; the others come in the order named:—kamala, croton oil, aloes, gamboge, linseed oil. Eserine and pilocarpine gives very satisfactory results, in doses of 2 grains eserine and 2 grains pilocarpine subcutaneously."

REPORTS.

BRITISH GUIANA. **Report on the Veterinary Division** (MILNE, A. Seton, Government Veterinary Officer). Reports of the Department of Science and Agriculture, for the Nine Months ended 31st December, 1915. Appendix IV. 5 pp. f'cap. 1916. Georgetown, Demerara: Govt. Printers.

The only serious outbreak of infectious disease dealt with in this report was one of anthrax, which was soon brought under control by the inoculation of nearly all the animals (12,000) in the infected area

Two outbreaks of contagious pneumonia occurred among mules.

There were no outbreaks of swine fever or glanders.

Mal de caderas did not reappear during the year.

An imported shorthorn bull kept for breeding purposes showed continuous daily high fever; its blood was found to contain trypanosomes, which were not identified. Intravenous injection of a Brazilian preparation called "sodium protosonate" every third day soon brought about a recovery and the disappearance of the trypanosomes from the blood.

A few details are added with regard to some small breeding experiments with imported pigs and a stallion.

CEYLON. **Administration Reports, 1916.** Report of Government Veterinary Surgeon [STURGESS, G. W.].—6 pp. f'cap.

A mild outbreak of influenza was the only infectious disease noted among horses.

856 cases of rinderpest were reported amongst cattle as against 1,493 last year; the mortality was about 77 per cent. 223 cattle were inoculated with anti-rinderpest serum and of these 138 remained free of disease; of the remaining 85 affected cattle, 38 recovered and 47 died.

There was a marked decrease in the prevalence of foot-and-mouth disease—284 cases as against 2,366 in 1915.

Four cases of surra were detected; two animals died naturally and two were destroyed.

Anthrax was found to be very prevalent amongst goats and sheep imported from India. Out of 76,820 of these animals imported into the quarantine station at Colombo 1,196 died from anthrax (1½ per cent.). Twenty deaths from this disease occurred in the island.

An outbreak of infectious ophthalmia occurred amongst cattle involving 64 cases. All recovered under treatment.

The outbreak of so-called swine septicaemia recorded in the preceding year ended in July, 1916. There were 274 cases as against 2,512 in 1915. "A possible carrier of this disease is *Ctenocephalus canis*, which was found infesting sick pigs."

Out of 23 cases of suspected rabies four were found positive.

The following insects were identified:—*Tabanus striatus* Fb., Kandy District, in April; *Pycnosoma flaviceps* Mag., the cause of myiasis in a dog's mouth, Colombo, November; and the tick *Boophilus australis* Fuller, Experiment Station, Peradeniya.

Losses due to parasitic gastritis caused by *Haemonchus contortus* are recorded.

Statistics are included with regard to disease returns, importation of animals, stock farm, and expenditure.

SOUTHERN RHODESIA. **Abridged Report of the Chief Veterinary Surgeon** (SINCLAIR, J. M.). Abridged Report of the Director of Agriculture for the Year 1916. pp. 5–7.

The greater part of this report deals with the outbreaks of East Coast fever in cattle recorded during the year. The year was marked by the appearance of this disease in the Mrewa District, in which it

Gwelo District after over ten years freedom from it. The source of the infection could not be traced in either case. Notwithstanding these outbreaks in previously clean districts the position shows a marked improvement as compared with the previous year. There were fewer fresh outbreaks -20 as against 35--and a greatly decreased mortality—382 as against 1,174. Of the 38 centres in which the disease occurred during 1915 only 15 showed infection during 1916. Details are added with regard to the method of dealing with these outbreaks in the various districts.

Shortly after the heavy rains fell in the Bulalima-Mangwe District in November several outbreaks of blackquarter occurred and the mortality was somewhat heavy. It was reported that animals of all ages contracted the disease and that a number recovered. Only two outbreaks of this disease had previously been recorded since the occupation of the country.

Tuberculosis was detected in one herd. Amongst the 12,719 head of slaughtered cattle exported to the Johannesburg abattoirs five cases of tuberculosis were discovered.

A few fresh centres of contagious abortion were discovered. Treatment by the injection of large doses of dead bacilli is still adopted and the results were apparently favourable.

No cases of anthrax, contagious pleuro-pneumonia of cattle, rabies, or glanders occurred.

The mortality from horse sickness was one of the slightest on record.

An outbreak of equine influenza occurred affecting about 90 per cent. of horses and many mules and donkeys. A slight mortality occurred among donkeys and mules but none in horses.

RECENT LITERATURE.

[Continued from this *Bulletin*, Vol. 5, No 2, pp. 134–140.]

PROTOZOAN PARASITES.

Alessandrini (S.). Le piroplasmosi ed i mezzi per prevenirle e combatterle. [Piroplasmosis ; Methods of Prevention and Eradication.]—*Ann. d'Igiene*, 1917. Feb. 28. Vol. 27. No. 2. pp. 100–110.

Bergman (A. V.) & Waxberg (H.). Uber Hämoglobinämie, Piroplasmose des Rindes in Schweden. [Redwater of Cattle in Sweden.]—*Zeitschr. f. Infektionskr. parasit. Krankheit. u. Hyg. d. Haustiere*, 1917. June. Vol. 18. Nos. 4 & 5. pp. 358–379. With 2 plates comprising 3 figs.

Chatton (Ed.). Les " Blastocystis," stades du cycle évolutif de Flagellés intestinaux. [" Blastocystis," Stages in the Development of Intestinal Flagellates.]—*C.R. Soc. Biol.*, 1917. June 2. Vol. 80. No. 11. pp. 555–560. With 1 plate comprising 13 figs.

Hahn (C. W.). On the Sporozoon Parasites of Wood's Hole and Vicinity. I. Further Observations on *Myxobolus musculi* from Fundulus.—*Jl. Parasit.*, 1917. Mar. Vol. 3. No. 3. pp. 91-104. With 4 text figs.

——. On the Sporozoon Parasites of the Fishes of Wood's Hole and Vicinity. II. Additional Observations upon *Myxobolus musculi* of Fundulus and a Nearly Related Species, *M. pleuronectidae* of *Pseudopleuronectus americanus.* —*Jl. Parasit.*, 1917. June. Vol. 3. No. 4. pp. 150–160. With 1 plate comprising 18 figs.

Ishiwata (S.). Note on a Species of Nosema Infecting *Attacus cynthia*, Drury.—*Jl. Parasit.*, 1917. Mar. Vol. 3. No. 3. pp. 136–137. With 8 text figs.

Journal of the American Medical Association, 1917. Feb. 17. Brazilian Trypanosomiasis—Chagas's Disease.—Extracted in *Jl. Trop. Med. & Hyg.*, 1917. Apr. 2. Vol. 20. No. 7. p. 84.

Kamm (Minnie Watson). The Development of Gregarines and Their Relation to the Host Tissues: (I) In *Stenophora lactaria* Watson.—*Jl. Parasit.*, 1917. Mar Vol. 3. No. 3. pp. 124–130. With 2 plates comprising 12 figs.

Kudo (Rokusaburo). Contributions to the Study of Parasitic Protozoa. II. *Myxobolus toyamai* nov. spec , a New Myxosporidian Parasite in *Cyprinus carpio* L.—*Jl. Parasit.*, 1917. June. Vol. 3. No. 4. pp. 163-170. With 2 plates comprising 45 figs.

Noguchi (Hideyo). Spirochaetes.—*Jl. Lab. & Clin. Med.*, 1917. Mar. & Apr. Vol. 2. Nos. 6 & 7. pp. 365–400 & 472–499.

[An admirable essay dealing with the whole subject of spirochaetes. No justice could be done to the papers in an extract and they should be consulted in the original by those interested. A bibliography consisting of 283 references is appended.]

—— & Akatsu (Seinai). Immunological Studies on Pure Cultures of Various Spirochetes.—*Jl. Experim. Med.*, 1917. June 1. Vol. 25. No. 6. pp. 765–788.

Plotz (Harry). Cultivation of *Spirochaeta obermeieri.*—*Jl. Experim. Med.*, 1917. July 1. Vol. 26. No. 1. pp. 37–39. With 1 plate van Saceghem (R.). Contribution à l'Etude de la Transmission du *Trypanosoma Cazalboui.* [Transmission of *T. cazalboui.*]—*Bull. Agric. Congo Belge,* 1916. Sept.–Dec. Vol. 7. Nos. 3 & 4. pp. 231–235.

[This article has already been extracted from another paper, see this *Bulletin,* Vol. 4. No. 4 pp. 159–160.]

METAZOAN PARASITES.

Arthropods (Acari, Flies, Ticks).

Craig (J. F.). The Presence of Psoroptes in the Ears of Sheep.—*Vet. Record,* 1917. June 2. Vol. 30. No. 1508. pp. 503–504.

Hadwen (S.). The Life History of *Hypoderma bovis* and *H. lineatum.*—*Jl. Amer. Vet. Med. Assoc.,* 1917. July. Vol. 4. No. 4. pp. 541–544.

Hall (M. C.). Notes in Regard to Horse Lice, Trichodectes and Haematopinus.—*Jl. Amer. Vet. Med. Assoc.,* 1917. July. Vol. 4. No. 4. pp. 494–504.

Larisch (P.). Die Bekämpfung der Gastrophilus larve. [Treatment of Gastrophilus Larvae.]—*Berlin. Tier. Woch.,* 1917. May 3. Vol. 33. No. 18. pp. 210–211.

Matthiesen, Peets & Dahlgrün. Viehverluste in den Niederungen der Leine und Aller durch die Stiche der Kriebelmücke, *Simulium reptans* L. [Losses among Cattle through the bites of *Simulium reptans.*]—*Berlin. Tier. Woch.,* 1917. Apr. 26. Vol. 33. No. 17. pp. 193–197.

Parrot (L.). Sur un nouveau Phlébotome algérien *Phlebotomus Sergenti,* sp. nov. (Note préliminaire). [A New Algerian Phlebotomus.]—*Bull. Soc. Path. Exot.,* 1917. July. Vol. 10. No. 7. pp. 564–567. With 11 figs.

Rhodesia Agricultural Journal, 1916. Aug. Vol. 13. No. 4. p. 464. —Tick Eradication Day.

Roubaud (E.). Le larve del *Gastrophilus equis*—Autoinoculazione e sviluppo primario nelle mucose della bocca. [Larva of *Gastrophilus equi*; Autoinoculation and Primary Development in the Buccal Mucous Membrane.]—*C.R. Acad. Sci.* Vol. 164. No. 111. Extracted in *Clinica Vet.,* 1917. July 15. Vol. 30. No. 13. pp. 397–398.

Scott (Hugh). Notes on Nycteribiidae, with Descriptions of Two New Genera.—*Parasitology,* 1917. July. Vol. 9. No. 4. pp. 593–610. With 1 plate comprising 5 figs.

Helminths.

Blanchard (R.). Monographie des Hémadipsines (*Sangsues terrestres*). [Monograph on the Haemadipsina (Land Leeches).]—*Bull. Soc. Path. Exot.,* 1917. July. Vol. 10. No. 7. pp. 640–675. With 1 plate comprising 14 figs., & 17 text figs.

Blanchard & Grellet. Valeur antiparasitaire du formol. [Value of Formalin as a Parasiticide.]—*Bull. Acad. Méd.,* 1916. Oct. 31. Extracted in *Rec. Méd. Vét.,* 1917. June 15. Vol. 93. No. 11. p. 298.

Cawston (F. G.). The Cercariae of Natal.—*Jl. Parasit.,* 1917. Mar. Vol. 3. No. 4. pp. 131–135.

Césari. Echinococcus Cyst in the Heart of a Horse.—*Bull. Soc. Cent. Méd. Vét.* Extracted in *Vet. Record,* 1917. May 19. Vol. 29. No. 1506. p. 481.

Ciurea (J.). Die Auffindung der Larven von *Opisthorchis felineus*, *Pseudamphistomum danubiense* und *Metorchis albidus*, und die morphologische Entwicklung dieser Larven zu den geschlechtsreifen Würmen. [The Discovery of the Larvae of *O.f.*, *P.d.*, and *M.a.* and the Morphological Development of these Larvae into Sexually Mature Worms.]—*Zeitschr. f. Infektionskr. parasit. Krankheit. u. Hyg. d. Haustiere.*, 1917. June. Vol. 18. Nos. 4 & 5. pp. 345–357 (continuation and end). With 1 table & 1 plate comprising 5 figs.

Dickenson (Campbell G.). A Case of Splenic Abscess, Secondary to Invasion of the Stomach Wall of a Horse by *Spiroptera Megastoma.*—*Vet. Jl.*, 1917. Apr. Vol. 73. No. 4. pp. 14–15.

Douma (S.). Uber einige Fälle von Sklerostomiasis bei Füllen und Pferden. [Sclerostomiasis in Foals and Horses.] *Berlin. Tier. Woch.*, 1917. May 3. Vol. 33. No. 18. pp. 208–210.

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Garcia è Izcara. Ethereal Extract of Male Fern in Distomatosis.—*El Pecuario Espanol.* Extracted in *Vet. Record*, 1917. Aug. 18. Vol. 30. No. 1519. p. 73.

Mendoza-Guazon (Maria Paz). A Case of Infestation with *Dipylidium Caninum.*—*Philippine Jl. Sci.*, 1916. Jan. Vol. 11. Sec. B. No. 1. pp. 19–31. With 3 text figs.

Moussu. Oil of Male Fern in Distomatosis.—*Bull. Soc. Cent. Méd. Vet.* Extracted in *Vet. Record*, 1917. Aug. 18. Vol. 30. No. 1519. p. 73.

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DISEASES DUE TO FILTERABLE VIRUSES.

Anónino. Vacunaciones preventivas contra la perineumonía contagiosa realizadas en 1916. [Preventive Vaccination against Contagious Pleuro-Pneumonia carried out in 1916.]—Extracted in *Rev. Hyg. y Sanid. Pecuarias*, 1917. June. Vol. 9. No. 3. pp. 189–190.

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Stockman (Stewart). Poisoning of Cattle with British Ragwort.—*Jl. Comp. Path. & Therap.*, 1917. June. Vol. 30. Pt. 2. pp. 131–134.

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TROPICAL DISEASES BUREAU.

TROPICAL VETERINARY BULLETIN.

Vol. 5.] 1917. [No. 4.

DISEASES DUE TO PROTOZOAN PARASITES.

Jack (Rupert W.). **Natural Transmission of Trypanosomiasis (*T. pecorum* Group) in the Absence of Tsetse-Fly.**—*Bull. Entom. Res.* 1917. Aug. Vol. 8. Part 1. pp. 35–41. With 2 maps.

In this article Jack records a series of observations made in Southern Rhodesia during the past seven years, tending to show that in certain conditions the transmission of trypanosomiasis has occurred more frequently in the absence of the tsetse fly than has been generally recognised. Details are thus given concerning limited outbreaks in six separate localities, situated at certain considerable distances from either the Gatooma tsetse area or the fly areas in the Sebungwe District. No tsetse flies were at any time discoverable in these localities. Four of these outbreaks involved cattle of which a certain number were used for draught purposes and had travelled over considerable distances, in some cases either in close proximity to or even into a known tsetse fly area; the remaining two outbreaks involved groups of swine. The situation of the infected centres and the routes taken by the draught oxen are carefully traced on the maps; the trypanosome was identified in each case by Bevan (Ll. E. W.).

In discussing these outbreaks the author calls special attention to the following points:—

"(1) In all cases the outbreak attained its height during the spring and summer months (October–April).

"(2) In all cases, in connection with which sufficient time has elapsed for such observation, there has been no recrudescence of the disease in the following season, although susceptible animals have still been kept in the same locality." (In a footnote the author points out that this is contrary to the experience in Barotseland and Portuguese East Africa.)

"(3) In all cases infection occurred only amongst animals that were herded together."

The time of the year in which the maximum number of cases are noted does not give any considerable assistance in identifying the species of fly responsible for the transmission of the disease as, apart from *Glossina morsitans* and certain species of Hippobosca, all the common blood-sucking flies are very much scarcer in winter than in summer. The most probable agents are included in the following species :—*Tabanus fuscipes*, *T. taeniola*, various species of Haematopota especially *H. pertinens*, *Stomoxys calcitrans*, Lyperosia, and mosquitoes. Of these *S. calcitrans* and mosquitoes were the only agents that were everywhere abundant throughout the season over which infection extended. The power of mechanical transmission need not necessarily, however, be confined to one species or to one family.

In addition the author maintains that the disease is not readily transmissible under Southern Rhodesian conditions by the above agents from chronic cases that live over until the rains or recover, and also that the transmitting agents are not capable of perpetuating the disease indefinitely or are only capable of doing so under exceptional circumstances. Experience in the territory where "fly-struck" cattle have been freely moved into fly-free areas has shown that "these movements have not resulted in *establishing* trypanosomiasis in any area away from the fly belts." It follows also that the method of transmission in the outbreaks described is of a mechanical and not of a cyclical nature and that the segregation of infected animals (on showing a rise in temperature) would in the absence of tsetse effectively check the spread of the disease.

"In no instance as yet recorded in Southern Rhodesia, however, can Glossina be definitely disassociated from the *inception* of the outbreak. The main point is, that the herding of 'fly-struck' cases with healthy animals is a practice attended with danger, especially in the spring and summer months."

CHAMBERS (F.). **Note on the Transmission of Animal Trypanosomiasis in Northern Rhodesia by Blood-Sucking Flies other than Glossina** —*Vet. Review.* 1917. Aug. Vol. 1. No. 3. pp. 222–227.

In this note Chambers summarises the observations and experiments of a number of authors who have reported the occurrence of trypanosomiasis in Northern Rhodesia and adjoining territories definitely known to be free of the tsetse fly. Some of these reports have already been extracted in this *Bulletin*. The author places no observations of his own on record.

In 1908 a chronic disease made its appearance amongst cattle grazing on the northern banks of the Zambesi; the disease was confined to an area extending from Livingstone to Sesheke and was popularly called Sesheke sickness. A detailed reference is made to G. E. OWEN's manuscript report (1912–1913) showing that the disease was caused by a trypanosome believed to be of the *dimorphon* type [this *Bulletin*, Vol. 2, No. 4, p. 167]. OWEN regarded the disease as being transmitted mechanically by means of Tabanidae.

KINGHORN and YORKE (1912) recorded a case of trypanosomiasis of a cow in a certain locality in North-Eastern Rhodesia, where no tsetse flies were found but Stomoxys and Tabanidae were common [this *Bulletin*, Vol. 1, No. 2, p. 79]. HART (R. L. L.) (1911) similarly observed cattle affected with trypanosomiasis on a tsetse-free farm in the same district; Pangonia and *Stomoxys nigra* were shown to be possible transmitters. MONTGOMERY and KINGHORN (1907) suggested that *Stomoxys calcitrans* and Lyperosia were capable of acting as transmitters. Failure to effect cyclical transmission by means of Tabanidae and ticks was demonstrated by KINGHORN and YORKE (1906) in the case of *T. rhodesiense*. Reference is also made to the failure to transmit *T. gambiense* by means of *Stomoxys nigra* and *S. calcitrans* by DUKE (1913) [this *Bulletin*, Vol. 1, No. 4, p. 215].

JOWETT (1910–11) described the occurrence of trypanosomiasis in a tsetse-free area in Portuguese East Africa after the introduction into a herd of some animals that had probably passed through a tsetse belt. Positive results were obtained in one feeding experiment with Stomoxys and Haematopota. ROGERS as long ago as 1901 showed that Tabanidae were capable of transmitting *T. evansi* within 24 hours after biting an infected animal.

DOEVE (W. C. A.). **Mededeelingen betreffende Surra.** [Information regarding Surra.]—*Veeartsenijkundige Bladen v. Nederl.-Indië.* 1917. Vol. 29. No. 1. pp. 4–15.

This article deals with the clinical course of naturally contracted surra in buffaloes. No information was obtainable regarding the period of incubation as experiments dealing with artificial infection were not performed. The disease is stated to commence as an acute infection, for this is the type observed in animals introduced into surra-infected districts from clean districts. During this acute preliminary stage the animals always show a rise of temperature (39° to 40° C.), erect hair and disturbances in connection with the digestive tract,—decreased appetite, irregularities and careless chewing of the cud, and alternating constipation and diarrhoea; the conjunctiva is markedly congested and keratitis is sometimes observed. Sometimes the animals show symptoms of complete blindness without any apparent abnormality in connection with the eyes. The buffaloes are also affected with nasal catarrh, sometimes with oedema around the pharynx, and more rarely with an intense oedematous swelling of the tongue. These last symptoms led the author at first to suspect that he was dealing with haemorrhagic septicaemia but inoculation of pigeons proved negative whereas inoculation of rats always proved fatal. Acute cerebral symptoms may also be observed—the animals fall suddenly, rise, run as if affected with mania, fall again, and then remain lying on one side quite exhausted. In young and debilitated animals death follows, but full-grown and strong animals generally recover after these attacks of vertigo. The animals also frequently have a frightened appearance and hold their heads raised as if affected with opisthotonus. Circling movements were not observed. This commencing acute stage lasts about a week, and animals that have recovered from this stage generally show no apparent abnormalities. When they have not completely recovered they can, however, be proved to be infected by blood examination and inoculation. If the animal is well fed and kept indoors so that re-infection cannot take place then it completely recovers in three months, as can be verified by blood inoculation. If the animal is turned out to grass and worked and especially if the feeding is neglected then complete recovery is retarded. The animal may be re-infected in districts where surra is enzootic.

Animals which do not completely recover can thus be divided into two groups, viz., those which show no apparent ill-effects from surra and those in which the disease produces gradually increasing ill-effects; this division depends largely on the nature of the feeding. In a district in the Dutch East Indies well known to the author the buffaloes to a large extent harbour surra trypanosomes in their blood; in the western part of this district, where the grazing is good, the animals do not seem to suffer from the parasites as much as they do in the poorer eastern part. In all cases exacerbations may appear during the chronic course of the disease owing to bad feeding and a return of the acute symptoms may thus set in. The chances of recovery depend largely on the number and severity of these relapses. Exposure to inclement weather such as long continued rain and wind is also liable to set up a return of the acute form and mortality, especially among calves; this mortality rate is arrested whenever the weather conditions improve; this factor, however, is not of such great importance as the feeding.

Clinically affected buffaloes should not be allowed to work with healthy oxen; they are not only a danger to the horses which may also be employed at the work but, if the animals are badly fed and the previously healthy animals contract the acute form of the disease, the latter will suffer from a steadily increasing loss of condition, whereas the chronic carriers of trypanosomes may not apparently suffer in the same conditions.

In buffaloes suffering apparent ill-effects from chronic surra the symptoms are as follows:—the animals become thin, the hind-quarters insensitive and the gait more or less unsteady; they are of very little use for work, the coat becomes dull and has a scabby eczematous appearance; necrotic patches about a couple of inches in diameter are produced, mostly under the breast and abdomen and on the limbs, and slough off leaving ulcers which refuse to heal. The conjunctiva is pale, sometimes yellowish in colour. There is increased lachrymation and pregnant females show a great tendency to abort, and are then often affected with retention of the afterbirth and uterine prolapse. If the mothers carry their calves to full time the milk secretion is so small that the calf born dies subsequently of starvation. Pregnant animals also frequently fall down and are unable to get up, being affected with paresis of the hind quarters. If the animals are unable to get up within 24 hours cardiac disturbances set in and they die.

Diagnosis of the disease was carried out by the injection of 1 c.c. of defibrinated blood from the affected animals intramuscularly into rats.

Post-mortem examination of buffaloes dead from surra shows no characteristic lesions. A gelatinous exudate was sometimes found in the subcutaneous and intermuscular connective tissue. There was in some cases a large quantity of serous exudate in the chest cavity. The lymphatic glands were always swollen and infiltrated with serous fluid; sometimes they contained minute petechiae. Petechiae are also observed under the epicardium and in the myocardium. Lesions in connection with the gastro-intestinal tract are also observed where digestive disturbances were noticed during life.

With the object of checking the spread of and suppressing the disease the Government authorities of the Dutch East Indies provide regulations for the closing of surra-infected pastures and prohibiting the export of infected cattle into clean districts. The author notes, however, that surra is enzootic throughout large low-lying districts especially along the coast, but that it is much rarer in the mountainous regions. In the infected districts one can thus only apply palliative measures taking specially into account the fact that feeding plays a very considerable part; mortality is highest during the rainy season when the sugar-canes are sown and when there is no stubble to turn the buffaloes out on to; in the dry season when the animals can find food on the harvested fields surra causes only sporadic losses. On the other hand, in horses losses from surra occur mostly during the dry season when they suffer more severely from the bites of Tabanidae and when they are turned out with the oxen on to the stubble.

MACFIE (J. W. SCOTT). **A Monomorphic Trypanosome of Man.**—*Report of the Accra Laboratory for the Year 1916.* pp. 60–66. With 1 coloured plate, 2 tables & 1 chart.

This article is of interest inasmuch as the trypanosome described showed a remarkable morphological resemblance to the commonly occurring trypanosome of domesticated animals in West Africa, viz., *T. vivax*. All the species and strains of trypanosomes that have hitherto been described as occurring naturally in the human blood have been of the polymorphic type, that is, they have shown long forms, shorter stumpy forms, and intermediate forms. In laboratory strains some of these organisms may in time become almost, if not quite, monomorphic, the long forms being very abundant and the stumpy forms rare or absent. Such strains must be regarded as abnormal, the result of a long series of inoculations into animals without the natural alternation in the insect host, and up to the present they have not been detected in nature.

The material used by Macfie in this study consisted of smears forwarded to him for examination from the blood of a native man at Tamale, Gold Coast. The history of the case suggested that the infection might have taken place about three weeks previously but apart from slight fever, which might not have been due to the trypanosomes, the patient had no symptoms of illness. After the first injection of atoxyl the trypanosomes disappeared and on subsequent examinations none could be detected. Two blood films were examined at different times while the parasites were discoverable in the blood and in both films a moderately heavy infection with trypanosomes was found. The living unstained organism was not examined by Macfie so that he was unable to give an account of its motility.

When fixed and stained the trypanosomes showed a characteristic appearance; all the individual elements were of similar shape and size. The shape of the body resembled that of *T. vivax* and showed an abrupt narrowing at the nucleus in front of which it tapered rapidly. The cytoplasm was clear showing an alveolar structure and were rarely found. The posterior end was usually blunt and not prolonged beyond the blepharoplast. The nucleus was long, oval, often rather diffuse, and sometimes divided into two or more pieces. The blepharoplast was large, rounded, and terminal or very nearly so. The undulating membrane was poorly developed and scarcely visible. The flagellum was well-developed and ran in most cases along the body in a gently curved line without deep undulations. There was always a long free portion to the flagellum.

The length of the trypanosome was slightly less than that of *T. vivax* and the range of variation was relatively small. Of 200 parasites measured the longest was 24μ, the shortest 18μ, average 20·7μ; these lengths were similar in the case of both films. These measurements indicate clearly the monomorphic character of the parasite.

TABLE I.

Measurements of Length of the Monomorphic Trypanosome found in the Blood of a Native of the Gold Coast.

Materials.	Number measured.	Lengths in microns.							Average lengths in Microns.
		18	19	20	21	22	23	24	
First specimen .	100	3	14	25	37	17	3	1	20·6
Second specimen .	100	1	13	23	39	16	5	3	20·8
Totals . .	200	4	27	48	76	33	8	4	—
Percentages .	—	2·0	13·5	24·0	38·0	16·5	4·0	2·0	20·7

In the remainder of this article Macfie discusses matter of such high veterinary importance that it is reprinted in full as follows :—

> "The length of *T. vivax* varies from 18μ or 19μ to 28μ or 29μ. The measurements given by various observers working with different strains from widely separated countries all show a general similarity (see Table II). According to Bruce and his collaborators (1911), the Uganda strain of 1903 ranged from 20μ to 27μ in a series of 80 specimens measured, and the crest of the curve formed by plotting the lengths occurred at 24μ; the Uganda strain of 1909 showed a crest at 25μ and was on the whole similar excepting only for the occurrence of a few unusually small forms 16μ or 17μ in length; and the Cameroons strain of 1903, of which also only 80 individuals were measured, showed a crest at 23μ and a single unusually long trypanosome 31μ in length. The measurements of *T. vivax* made by Kinghorn and Yorke (1913), in Rhodesia ranged from 19μ to 29μ, and the curve reached its crest at 23μ; those made by me (1914) in Southern Nigeria ranged from 19μ to 28μ and showed the crest at 25μ; and a series from cattle on the Gold Coast (1915) ranged from 18μ to 29μ and their curve reached its highest point at 23μ. All these observations, therefore, agree in describing the length of *T. vivax* as having a restricted range varying from 18μ to 29μ, except in rare instances, and the curves formed by distributing the measurements show a decided peak at a length varying from 23μ to 25μ.

TABLE II.

The Distribution, by percentages, according to length of Various Strains of *Trypanosoma vivax.*

Strain.	Lengths in Microns.																
	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Average.
Uganda, 1903 (Pordage's ox). S. S. C.	—	—	—	—	2·5	3·7	22·5	22·5	30·0	15·0	2·5	1·3	—	—	—	—	23·3
Uganda, 1909. S. S. C.	0·6	1·1	—	1·1	2·2	1·7	6·1	11·6	19·5	24·4	22·2	6·7	1·7	1·1	—	—	24·4
Cameroons, 1903. S. S. C.	—	—	1·2	2·5	6·3	10·0	12·5	17·5	10·0	13·7	11·3	11·3	2·5	—	—	1·2	23·7
Rhodesia, 1912. Kinghorn and Yorke.* ..	—	—	—	1·5	2·5	8·5	16·0	22·5	18·0	14·5	9·5	4·5	2·0	0·5	—	—	23·63
Southern Nigeria, 1914. Macfie	—	—	—	1·0	4·0	4·0	13·0	19·0	23·0	27·0	4·0	3·0	2·0	—	—	—	23·74
Gold Coast, 1915. Macfie	—	—	1·0	2·0	5·0	12·0	18·0	29·0	18·0	9·0	3·0	2·0	—	1·0	—	—	22·64

* These authors do not record the actual figures, those given here are taken from their Chart.

"On comparing these measurements with those of the monomorphic trypanosome found in man it is evident that *T. vivax* is slightly the larger organism. In the human parasite the minimum length was about the same as that of *T. vivax*, but the longest individuals did not exceed 24μ, whereas *T. vivax* not infrequently measures 28μ or 29μ, and according to Bruce may even reach 31μ. The most common length that is, the situation of the crest of the curve—was also different, viz., 21μ instead of 23μ to 25μ; and the average length, 20·7μ was less than that of any of the strains of *T. vivax*.

"The most detailed study of the length of *T. vivax* is, however, that of Blacklock (1912), which has not been referred to above on account of the difficulty of including his measurements in the table given. This author measured the length of 1,000 trypanosomes in goats at the Runcorn Research Laboratories, the strain being one isolated from a horse sent to Liverpool from the Gambia by Professor Todd. The longest of these trypanosomes measured 26·7μ, the shortest 15·5μ, and the average worked out at 21·7μ; 57·8 per cent. of the parasites measured between 20μ and 23μ. In the chart compiled by Blacklock from his measurements, the crest of the curve occurs at 22·5μ. To these measurements of *T. vivax* those of the monomorphic human trypanosome approximate more closely than they do to any of those previously referred to; and as in one of Blacklock's groups of 100 parasites the average length was 20·9μ, there cannot be said to be any appreciable difference between the lengths of the two organisms.

"Another trypanosome, *T. uniforme*, resembles in some respects the human parasite found in the Gold Coast. This organism was discovered by Bruce and his collaborators (1911) in Uganda in the blood of oxen, and was described as resembling *T. vivax* closely but differing from it 'in size, and perhaps to a slight extent in shape.' This trypanosome measured in length from 12μ to 19μ, and averaged 16μ; and the crest of the curve representing the distribution of 200 individuals in respect to length was at 16μ. *T. uniforme* was therefore a smaller organism than the monomorphic trypanosome described in the paper, although in general appearance it resembled it closely.

"The third trypanosome usually included in the same group as *T. vivax* is *T. caprae*, a parasite discovered by Kleine in goats in the neighbourhood of Lake Tanganyika. Kleine (1910) described this trypanosome as being larger than *T. brucei*, and stated that some forms had, others had not, a free portion to the flagellum. Bruce (1913) and his fellow investigators subsequently studied this organism in Nyasaland, and measured 500 individuals (taken from various animals) which ranged in length from 32μ to 18μ, averaged 25·5μ, and formed a curve similar to that of a monomorphic trypanosome with a peak at 25μ. They considered that '*T. caprae* differs from *T. vivax* in that it is heavier built and altogether has a larger and clumsier appearance,' and they denied the statement made by Kleine that some forms were without a free flagellum. So far as the actual measurements of length are concerned, there is no great difference between *T. vivax* and *T. caprae*, and it may be doubted if they could be separated by this character; it may be pointed out also that the difference in size between *T. vivax* and the monomorphic human trypanosome is greater than that between *T. vivax* and *T. caprae*. . . . Bruce noted as a curious fact that *T. uniforme* and *T. vivax* had not been met with by the Commission in Nyasaland, and suggested that this might be due 'to the absence of *Glossina palpalis*, which is their carrier, while *T. caprae* is carried by *G. morsitans*.' Kinghorn and Yorke however have shown that *T. vivax* is carried also by *G. morsitans*. It is not improbable, therefore, that *T. caprae* may be only a variety of *T. vivax*.

"The trypanosome found in the blood of this native of the Gold Coast appears to be intermediate between *T. vivax* and *T. uniforme* as regards its morphology. All three organisms have the same general form, but *T. vivax* is the longest, *T. uniforme* the shortest, and the Gold Coast trypanosome occupies an intermediate position nearer to *T. vivax*, however, than to *T. uniforme*. . . .

"From the very small amount of materials available, and in the absence of any observations on the pathogenicity of the strain to animals.

it is impossible to decide the species of this trypanosome, but morphologically its similarity to *T. vivax* is very striking.

"Neither *T. uniforme* nor *T. caprae* has hitherto been identified in the Gold Coast, but *T. vivax* is an exceedingly common parasite of domestic animals in West Africa, and was found in no less than 76 per cent. of the hump backed cattle examined by me at Accra (1914). It would therefore be a serious matter if this species were proved to be pathogenic to man. *T. vivax* is not pathogenic to monkeys, and has been regarded as harmless to man, an assumption which is strongly supported by the fact that a human infection has never yet been recorded, although the organism is widely distributed and very abundant in Africa. Blacklock and Yorke (1913), however, succeeded in rendering a strain of *T. vivax* pathogenic to rabbits, which are usually immune, and in the same way other refractory animals may become infected. It is possible, therefore, that occasionally, under abnormal conditions, this trypanosome might succeed in infecting man or might transiently appear in his blood, for it is transmitted by the bites of tsetse flies (*G. palpalis*, *G. morsitans*, and *G. tachinoides*) to which the natives of the Gold Coast are constantly exposed. It should be mentioned in this connection that Blacklock and Yorke examined the strain of *T. vivax* they used after it had been passed through six generations of rabbits, but that they failed to detect in it any morphological changes. In this case, then, no structural modifications appeared to accompany the alteration in pathogenicity which enabled the trypanosome to infect an unusual host.

"The description of this organism, incomplete though it is, is put on record in order to draw the attention of future workers in the Gold Coast to the fact that there is in West Africa a species of monomorphic trypanosome capable of infecting man."

BRUGGEMAN (J. P. I.). **Anaplasmose bij Buffels (voorloopige mededeeling).** [Anaplasmosis in Buffaloes. Preliminary Communication.] —*Veeartsenijkundige Bladen v. Nederl.-Indië.* 1917. Vol. 29. No. 2. pp. 175–181.

This note deals with a serious outbreak of disease which first appeared among buffaloes in the district around Rembang on the northern coast of Java, Dutch East Indies. The mortality rose to 28 out of 200 in the first affected centre. Blood smears taken from the animals first affected showed an excessive number of trypanosomes and as the symptoms shown consisted in an excessive flow of saliva, swelling of the limbs, anaemia, varying temperature and emaciation the disease was first diagnosed as surra. However, from time to time smears taken from animals showing manifest clinical symptoms showed no trypanosomes; hence the presence of another disease was suspected, especially on account of the high mortality. Besides, it is stated by this author that surra always runs a chronic and favourable course in buffaloes. Eruptions and desquamation of the skin together with severe diarrhoea were observed in addition in the affected animals.

The disease was later found to have become widespread in other districts and examination of blood preparations from these places always gave negative results as to the presence of trypanosomes; inoculation of the small experimental animals likewise gave negative results. A more careful examination of blood smears after staining with Giemsa and Leishman was then resorted to and these showed the presence of red corpuscles in good condition showing especially at their margins a number of darkly staining points. In rare cases these points were situated towards the centres of the corpuscles. The disease was thus diagnosed as being due to *Anaplasma marginale*. The blood of affected animals, especially when the disease was of several days standing, invariably presented this appearance. Towards death the bodies became greater in number and at the same time peculiar degenerative appearances were seen in the interior of the corpuscles in the form of rounded or crescentic colourless spots or cavities which appeared as if they had previously enclosed the parasites; poikilocytosis and anisocytosis and other anaemic changes were then seen.

According to the author the disease in Java could be recognised by the following symptoms :—

(1) A profuse green watery diarrhoea containing no blood or mucus.

(2) A skin eruption which gives the animal a mildewed appearance or as if it was covered with fine wire netting. The crusts originate with the formation of small vesicles especially on the back, loins, and croup. These burst and form a white scurf which on falling off leaves behind an unpigmented patch of skin. About the base of the ears especially long furrows oozing blood may be thus formed. This mildewed appearance generally begins two or three days before the onset of severe diarrhoea and the refusal of food.

(3) Sunken eyes with a watery, sometimes a little muco-purulent, discharge; always very marked photophobia with blinking of the eyes.

(4) Temperature as a rule between 100·4 F. (38° C.) and 101·4° F. (38·7° C.); the muzzle is not dry.

The disease was never observed affecting cattle. No ticks were found in spite of a careful search. Exceptionally a few buffaloes recovered but the great majority died in from two to five days after the onset of diarrhoea with marked emaciation. It is stated that this mortality due to the *marginale* agrees with the finding of THEILER that this variety produces a virulent form of the disease while the *centrale* sets up a milder form.

The bodies found within the corpuscles were distinguishable from degenerative formations (*Randkörnchen*) inasmuch as the latter stained of an azure-red colour; no piroplasms were discoverable.

A longer report is promised when the author has been able to consult the literature and finish a number of experiments he has in hand concerning the disease.

PRICOLO (Antonio). **Classificazione della piroplasmosi tunisina.** [Classification of Tunisian Piroplasmoses.]—Reprint extracted from *Moderno Zooiatro* 1915. 2 pp.

In this note Pricolo reproduces some correspondence which took place between him and THEILER regarding some preparations sent to the latter for examination. "The parasites found in the smears were indistinguishable from those found in the blood of cattle affected with East Coast fever in South Africa and in particular the presence of Koch's blue bodies left no room for doubt but that the organism was *Piroplasma parvum*."

The blood from affected animals failed to infect susceptible animals by direct inoculation and the progeny of ticks fed on infected cattle were found to be innocuous. Sardinian cattle were found to show visible symptoms within about 20 days after contact with infected Tunisian cattle. Imported Italian cattle often revealed the presence of *Piroplasma bovis* in their blood.

Stefko (W.). **Piroplasmose et Anaplasmose en Turquie (1916).** [Piroplasmosis and Anaplasmosis in Turkey, 1916.]—*Bull. Soc. Path. Exot.* 1917. Oct. Vol. 10. No. 8. pp. 723–724.

Several cases of the above diseases were observed in oxen imported from Russia into Turkey (Trebizond, Platana, and Rizeh, etc.) during the summer of 1916. The mortality produced was very high (80–90 per cent.). The parasites found in smears from the spleen belonged to *Piroplasma bigeminum, annulatum* and to *Anaplasma centrale.*

Infection with both parasites was very common. The intermediate host was *Boophilus annulatus.* The eggs of this tick were infected to a very large extent with piroplasms. *Ixodes corniger* Kol. and *Rhipicephalus simus* Koch were not so commonly found in this region.

França (Carlos). **Sur la classification des hémosporidies.** [Classification of the Haemosporidia.]—Reprint from *Jl. de Sciências Matemáticas, Fisicas e Naturais.* Series 3. No. 1. 41 pp. With 29 text figs. & 1 table. 1917. Lisbon: Imprensa Nacional.

"In the classification of *Haemocytozoa* or *Haemosporidia* the greatest confusion still exists and it is thus desirable to revise their classification. The confusion arising in connection with the systematic position of these protozoa is undoubtedly due to the very strict parasitism of these cytozoa. This permanent parasitism impresses on the different forms a particular aspect which renders a systematic classification difficult; but at the same time the peculiarities of this parasitism tends to justify the adoption of the order *Haemosporidia* to which Mesnil, in a recent work, denies any taxonomic value.

"In our opinion one should consider as belonging to the *Haemosporidia* only those coccidiform protozoa adapted to intra-corpuscular life.

"The *Haemosporidia* constitute one of the sub-orders of *Sporozoa* and may be characterised thus:—

"Protozoa living in the blood corpuscles, either in the red corpuscles or in the leucocytes; possessing a schizogonic phase in the body of the vertebrate and a sporogonic phase in the invertebrate. The invertebrate in which is passed the sexual cycle of the protozoon and which represents its primitive host is the transmitting agent of these forms.

"The sub-order *Haemosporidia* constitutes with the sub-order *Coccidia*, the order *Coccidiomorpha.*

"The French parasitologist Mesnil, in the work above referred to, states: 'França speaks of the order of *Haemosporidia.* He means to convey, no doubt, by this term the re-union of three families—*Plasmodiidae* (or *Haemamoebidae*), *Haemogregarinidae*, and *Piroplasmidae.* I believe that in the actual state of our knowledge, such a grouping is no longer possible.'

"Mesnil bases this statement on the fact that the *Haemosporidia* present sexual phenomena which vary markedly according to the families considered: of the type *Adelea* (*Haemogregarina*), of the type *Eimeria* (*Plasmodidae*), or of a type intermediate between these two (*Piroplasmidae*), and also inasmuch as they constitute 'a heterogeneous collection which have no characters in common except the general characters of the Coccidia.'

"We cannot follow Professor Mesnil in these conclusions. We believe simply that one has to recognise common ancestral forms in the origin of *Coccidia* and *Haemosporidia* and that this explains the analogy and even the identity existing between the multiplication phenomena of the forms belonging to these two sub-orders.

"The *Haemosporidia* must, in addition, represent the most recent *Sporozoa*; several of these forms are still tentatively adapting themselves to the vertebrate body, and this is manifested by their pathogenicity, which always signifies a lack of harmony, the result of incomplete adaptation.

"The common ancestors and identical conditions of life (intracellular habitat) impresses on the two sub-orders of *Coccidiomorpha* a certain number of common characters.

"We thus accept the sub-order *Haemosporidia*, which in the classification of protozoa should have the following place :—

Class.	**Sub-class.**	**Order.**	**Sub-order.**
"Sporozoa	Telosporidia	Gregarinida	
		Coccidiomorpha	Coccidia Haemosporidia
	Neosporidia		

"The sub-order *Haemosporidia* comprises four families :—

"1. *Haemogregarinidae.*
"2. *Plasmodidae.*
"3. *Piroplasmidae.*
"4. *Toxoplasmidae.*"

The bases for the classification of the haemosporidia into four families are indicated in the accompanying table opposite.

1. Fam. *Haemogregarinidae* Neveu Lemaire, 1901.

(a) Genus *Haemogregarina* Danilewsky, 1885. (Syn.: *Drepanidium* Lankester, 1882 pro parte; *Karyolysus* Labbé, 1894; *Danilewskya* Labbé, 1894.)

"Vermicular non-pigmented haematozoa living within the blood corpuscles. Schizogony within cysts in the internal organs, either within the corpuscles (Haemogregarines of tortoises, snakes, and fishes) or outside the corpuscles (Haemogregarines of mammals and lizards)."

A list of 225 species together with their hosts and geographical distribution is given.

(b) Genus *Hepatozoon* Miller, 1908. (Syn.: *Leucocytozoon* Danilewsky, 1889, pro parte; *Leucocytogregarina* Porter, 1909.)

"Vermicular haematozoa without pigment and living within leucocytes. Schizogony inside cysts within the internal organs, sometimes in the cells of the organ.

"All forms hitherto described have been found in mammals."

A list of 22 species is given; the most important one appears to be *H. canis* Bentley and James, 1905, found in the dog in India, Australasia, and Africa.

2. Fam. *Haemamoebidae* Ross, 1889. (Syn.: *Plasmodiidae* Luhe, 1906.)

(a) Genus *Plasmodium* Marchiafava and Celli, 1885. (Syn.: *Polychromophilus* Dionisi, 1898.)

"Pigmented haemamoebidae in which the gametocytes are identical with the schizonts. Schizogony in the peripheral blood."

					Genera.	Families.
Haemosporidia inhabiting	the blood	Non-pigmented.	Without flagelliform microgametes.	Schizogony in the interior of cysts in the internal organs.	*Haemogregarina* Danilewsky, 1885. *Hepatozoon* Miller, 1908.	*Haemogregarinidae* Neveu - Lemaire, 1901.
				Schizogony within the corpuscles of the circulating blood or in the interior of the internal organs.	*Piroplasma* Patton, 1895. *Smithia* França, 1909. *Nuttallia* França, 1909. *Theileria* Bettencourt and Borges, 1907. *Paraplasma* Seidelin, 1912. *Achromaticus* Dionisi, 1900. *Rangelia* Carini and Maciel, 1914. *Rossiella* Nuttall, 1910. *Elleipsisoma* França, 1910.	*Piroplasmidae* França, 1909.
			Flagelliform microgametes.	Schizogony in the internal organs.	*Leucocytozoon* Ziemann, 1898.	*Haemamoebidae* Ross, 1899.
		Pigmented	Flagelliform microgametes.	Schizogony in the corpuscles in the circulation or in the internal organs	*Plasmodium* Marchiafava and Celli, 1885. *Laverania* Grassi and Feletti, 1889. *Haemoproteus* Kruse, 1890. *Proteosoma* Labbé, 1893. *Haemocystidium* Castellani and Willey, 1904.	
	the organs	Non-pigmented	Without flagelliform microgametes.	Schizogony in the interior of cells.	*Toxoplasma* Nicolle and Manceaux, 1908.	*Toxoplasmidae* n.f.

A list of 28 species is given, including the causal agents of human tertian and quartan malarial fever, and *P. canis* Castellani and Chalmers, 1908, found in the dog in Ceylon.

(b) Genus *Laverania* Grassi and Feletti, 1889.

> "Pigmented haemamoebidae in which the gametocytes (crescentic-shaped bodies) are different in shape from that of the schizonts. Schizogony within the blood corpuscles in the internal organs."

This genus comprises only one species, viz., *L. malariae* (or *Plasmodium falciparum*), the causal agent of tropical malarial fever in man.

(c) Genus *Haemoproteus* Kruse, 1890 (= *Halteridium* Labbé, 1894).

> "Pigmented amoeboid dumb-bell shaped Haemamoebidae which surround but do not displace the nucleus of the corpuscle. Schizogony in the internal organs. Exceptionally, schizogony in the circulating blood. Two groups of merozoites at each pole of the dumb-bell."

A list of 18 species found in birds, including the well-known Haemoproteus of the pigeon, is given, and also a long list of various species of birds in which the parasites have been found in different parts of the world; three species are known to occur in tortoises and snakes.

(d) Genus *Proteosoma* Labbé, 1893.

> "Pigmented Haemamoebidae, generally displacing the nucleus of the invaded corpuscle. Schizogony in the circulating blood. Merozoites arranged around a residual body."

Twelve species are enumerated, including the Proteosoma of the common sparrow.

(e) Genus *Haemocystidium* Castellani and Willey, 1904.

> "Pigmented Haemamoebidae which in their adult stage are oval or rounded in shape (never amoeboid), with a perfectly regular contour, vacuolated cytoplasm, and an almost invisible nucleus. Very marked sexual dimorphism. The nucleus of the corpuscle is at a very early stage pushed towards one of the extremities of the corpuscle. Schizogony in the circulating blood by means of binary or quaternary division."

Three species of no great importance are mentioned.

(f) Genus *Leucocytozoon* Ziemann, 1894.

> "Non-pigmented Haemamoebidae living in the corpuscles in which they produce marked changes in appearance. Very distinct sexual dualism. Gametes rounded (type B), or oval (type A), producing in the latter case a peculiar deformity of the corpuscles, viz. two tapering polar expansions. Schizonts in the internal organs where schizogony takes place. Flagelliform microgametes. Large, elongated, non-pigmented ookinete."

A large number of species of both types have been described in birds and 42 species are enumerated in this paper, including *L. anatis* Wickware, 1915 (type A), found in the duck in Canada.

Fam. *Piroplasmidae* Franca, 1909.

(a) Genus *Piroplasma* Patton, 1895 (= *Haematococcus* Babes, 1888; *Pirosoma* Smith and Kilborne, 1893; *Babesia* Starcovici, 1893; *Apiosoma* Wandolleck, 1895).

> "Haematozoa showing during one of their stages a pear-shaped form and arranged in pairs within the same corpuscle. Division takes place by a process of gemmation."

This genus contains some of the most important Haematozoa of the domesticated animals. Eight species are given, of which the following are the more important :—

Species.	Host.	Intermediate host.	Distribution.
P. bovis Babes, 1888.	Bovines.	*Boophilus annulatus, australis* and *decoloratus.*	North and South America, Australia, Asia and Africa.
Synonym : *P. bigemina* Smith and Kilborne, 1893.	Bovines.		America.
P. divergens McFadyean & Stockman.	Bovines.	*Ixodes ricinus.*	Europe.* (In Portugal the disease caused by this species is called *ferrujão.*)
P. ovis Starcovici, 1893.	Sheep.	*Rhipicephalus bursa.*	Italy, Turkey, Roumania and Transcaucasus.
P. canis Piano & Galli-Valerio, 1895.	Dog.	*Rhipicephalus sanguineus, Haemaphysalis leachi.*	The whole world.
P. caballi Nuttall, 1910.	Horse.	*Boophilus annulatus, Dermacentor reticulatus.*	Russia, Roumania, Transcaucasus, Siberia.

(b) Genus *Smithia* França, 1909.

"Haematozoa showing during one of their stages a pear-shaped form. The majority of the pear-shaped parasites occupy the whole diameter of the corpuscle and are not arranged in pairs. Multiplication by division into four (in the shape of a cross)."

Two unimportant species are at present known.

(c) Genus *Nuttallia* França, 1909.

"Oval, more rarely pear-shaped haematozoa. Multiplication forms in the shape of a cross. The elements composing the cross possess a relatively abundant protoplasm. No rod-shaped elements."

Eight species are enumerated, one of which, viz., *N. equi* Laveran, 1899, is pathogenic for the horse and is found in Italy, Africa, Transcaucasus, India, Annam, Brazil; intermediate host, *Rhipicephalus bursa.* "The disease caused by this piroplasm has been called Nuttalliasis, and is more severe than that due to *P. caballi* (Carpano)."

(d) Genus *Theileria* Bettencourt, Franca, & Borges, 1907.

"Rod-shaped haematozoa which on division give rise to elements taking the form of a cross. The elements of the cross are very small, rounded, and almost exclusively composed of chromatin."

"This genus contains pathogenic species, some of which are of great economic importance on account of the mortality they produce among cattle."

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* From this table the reader might be led to believe that *P. divergens* was the only piroplasm found affecting cattle in Europe. Attention is, however, called to McFadyean and Stockman's original article, in which they state :—

"We have also satisfied ourselves that the piroplasma bigeminum is a cause—we think probably the common cause—of redwater in Great Britain, and for purposes of comparison we give here (fig. 1 and fig. 2) illustrations respectively of an English strain of the piroplasma bigeminum and of the piroplasm which we hold to belong to a different species" (*Jl. Comp. Path. and Ther.*, 1911. Dec. Vol. 24. Part 4. p. 340).—Ed.

Of the 10 species enumerated the following appear to be the more important :—

Species.	Host.	Intermediate host.	Distribution.
Theileria annulata Dschunkowsky, 1904.	Bovines.		Russia.
T. parva Theiler, 1904.	Bovines.	*Rhipicephalus appendiculatus, R. simus, R. evertsi, R. nitens, R. capensis.*	Africa (producing the diseases known as East Coast Fever, Rhodesian "redwater," *Amakebe* in Uganda, Mediterranean Coast Fever (Carpano).
T. mutans Theiler, 1907.	Bovines.	*R. simus, R. evertsi.*	Africa (at one time alleged to be the cause of gall-sickness).
T. dama Bettencourt, França and Borges, 1907.	*Cervus dama.*		Portugal.
T. hippotragi Todd & Wolbach, 1912.	*Hippotragus equinus.*		Africa.
T. stordii França, 1912.	*Gazella grantii.*		Abyssinia.
T. ovis Rodhain, 1916.	Sheep.		Africa.

(e) Genus *Paraplasma* Seidelin, 1912.

" Rod-shaped elements as in the case of *Theileria.* Ring-shaped forms as in the case of *Plasmodia.* Schizogony in the capillaries of the internal organs especially in the kidneys."

One species has been described, viz., *Paraplasma flavigenum* Seidelin, the alleged causal agent of yellow fever in man (intermediate host *Stegomyia calopus*).

(f) Genus *Achromaticus* Dionisi, 1900.

" Sickle-shaped, pear-shaped, or rounded elements. Schizogony within the red corpuscles usually giving rise to numerous merozoites. Very elongated forms may occupy the whole diameter of the corpuscle."

This genus contains one species found in different species of bats, and another of importance—*A. gibsoni* Patton, 1910, inasmuch as it has been alleged to be pathogenic for sporting dogs (*Canis aureus*) in Madras.

(f) Genus *Rangelia* Carini and Maciel, 1914.

" Rounded, oval, or pear-shaped forms arranged most frequently in pairs. Schizogony in the protoplasm of the connective tissue and endothelial cells of the internal organs producing a very large number (30 to 100) of merozoites."

One species only is known, viz., *Rangelia vitalli* Rangel Pestana, 1910, a disease-producing organism of dogs in Brazil. The disease caused by this protozoon is known as *Nambiuvù.*

(g) Genus *Rossiella* Nuttall, 1910.

" Very large, usually rounded haematozoa. Rounded nucleus. Schizogony in the interior of the corpuscles by means of binary division, which may be repeated a certain number of times, thus producing a rather variable number of large merozoites."

One species only is known, viz., *Rossiella rossi*, Nuttall, 1910, parasitic in *Canis adustus* (Africa).

(h) Genus *Elleipsisoma* França, 1910.

"Elliptical or oval non-pigmented forms living within the corpuscles which become deformed and deprived of haemoglobin. Relatively large nucleus usually placed close up to one of the margins of the haematozoon. Schizogony and binary division in the lung."

This genus contains one species found in moles in various countries in Europe.

4. Fam. *Toxoplasmidae* n.f.

This family contains one genus *Toxoplasma* Nicolle and Manceaux, 1908.

"Oval or kidney-shaped protozoa which reproduce by longitudinal division or by multiple division in the interior of the invaded cells. Found in the mononuclears and polynuclears in the spleen and other organs, and, exceptionally, in the blood."

This genus comprises already thirty known species some of which are extremely pathogenic, the latter including *Toxoplasma cuniculi* Splendore, 1909, pathogenic for the rabbit (*Oryctolagus cuniculus*) in Brazil and *T. canis* Mello, 1910, pathogenic for the dog in Italy, Germany and Brazil. Another species *T. pyrogenes* Castellani, 1914, has been incriminated as the cause of chronic fever in man in India and the Black Sea Coast.

"There are found among the Haemosporidia certain genera whose systematic position has not yet been determined on account of our lack of knowledge concerning certain peculiarities in their biology.

"The genera *Immanoplasma*, *Toddia*, *Microsoma*, and *Pirhemocyton* belong to this category, but they, however, possess certain characters in common which enable one to group them together."

These genera comprise only a few species of no economic importance and thus the description of their characteristics is omitted from this extract.

There are still a number of Haematozoa which on account of their nuclear dimorphism seem to be closely connected with the flagellates. This has been proved in the case of Leishmania and thus these organisms are excluded from the Haemosporidia. The same has not yet been shown in the case of the genera Dactylosoma, Nicollia, and Endotrypanum, and thus although França gives the characters by means of which they can be identified he is convinced that some of them must later be removed from the order Haemosporidia.

DISEASES DUE TO METAZOAN PARASITES.

Wirth (D.). **Filariosen bei einheimischen Pferden (Vierte Mitteilung).** [Filariasis in Native (Hungarian) Horses, Fourth Report.]—*Zeitschr. f. Infektionskr. parasit. Krankheit. u. Hyg. d. Haustiere.* 1917. June. Vol. 18. Nos. 4 & 5. pp. 380–413. With 4 plates comprising 10 figs.

In reports published 1911–1913 the author dealt with the question of the presence of microfilariae in the blood of Hungarian horses, and principally with the clinical symptoms observed. The present paper is concerned with the morphology and biology of the parasites and their further development into what is considered as the adult stage.

The affected animal used for these studies was a four-year old horse bred at a military stud where numerous cases of filariasis had occurred especially during the preceding summer. The horse was kept under clinical observation for four months (May-August, 1914); during this period the temperature was slightly subnormal, breathing 10 to 16, and pulse 30 to 40 per minute, heart-beats irregular, intermittent after every four beats, and heart action very violent on slight exertion; the appetite was somewhat depraved but otherwise the horse ate well and its general condition was good. The urine was normal and no microfilariae were found in the sediment. From 1 to 3 microfilariae were found in each drop of blood. Blood examination gave the following figures:—haemoglobin, 97·5° (estimated by SAHLI's method); red corpuscles, 11,158,000; white corpuscles, 13,376; proportion between red and white corpuscles, 1 : 804; lymphocytes, 30·8 per cent.; polynuclear leucocytes, 60 per cent.; eosinophiles, 5·2 per cent. (4–8·3 per cent.); mononuclears and transition forms 4 per cent.

Clinical symptoms of microfilariasis in the horse.—The following is a summary of the author's previous reports. Filariasis appears generally during the hotter part of the year. Hitherto young animals (foals) more especially have been found affected; the oldest was eight years old. The body temperature was usually subnormal or sometimes very slightly above normal. The affected animals show general lassitude and a somewhat diminished appetite which is occasionally temporarily increased. The most noticeable symptom is the rapid exhaustion of the animal at work, thus rendering riding horses useless. It is not decided whether the irregularity in the action of the heart shown in some animals is a characteristic symptom. The sudden collapse of the animal especially in the stable is a further symptom. MANDEL was of opinion that the nematode worm found in the eyeball of horses affected with moon-blindness was probably connected with filariasis. None of the author's cases was simultaneously affected with moon-blindness and in a military stud where moon-blindness was not uncommon no microfilariae were found in the horses so affected. As a rule the disease was found to last from three months up to a year. The number of parasites in a drop of blood was found usually to vary between one and six, but sometimes the number might drop down to one in every five or ten drops of blood and occasionally single specimens only could be found after prolonged searching. In all cases, however, marked eosinophilia was discoverable; whilst in normal horses the proportion of eosinophiles is about 3 per cent. in filariasis they may increase up to over 8 per cent. An appreciable leucocytosis was not observed and the number of red corpuscles and the haemoglobin content were approximately normal. Leucocytosis and anaemia on the other hand are common in canine filariasis. The percentage of lymphocytes was with one exception high, thus corresponding with YAKIMOFF's observations regarding filariasis in Turkestan. Microfilariae may be present in the blood of horses showing no apparent symptoms of disease.

The author holds that the microfilariae were responsible for the clinical symptoms inasmuch as (1) no other causes were discoverable, (2) where observation was continued over a long-enough period it was found that a complete recovery set in after the disappearance of the microfilariae from the blood, (3) other authors describe similar conditions in man as well as other animals caused by microfilariae. In those cases where microfilariae are found in apparently healthy horses they are very few in number and not always present.

The disease generally runs a favourable course but recovery generally takes a long time,—several weeks or months. In the author's cases recovery seemed to be complete, at least no recurrence was observed.

The author is of opinion that no drugs are beneficial in the treatment of affected animals, recovery taking place naturally in two to four months. Atoxyl administered in from 1 to 2 gramme doses subcutaneously gave negative results.

Technique of examination for microfilariae.—Blood for testing is best taken by puncturing the facial vein; the necessary amount of blood may also sometimes be obtained by incising the mucous membrane of the lips; large quantities if needed are taken from the jugular vein. Thick smears are usually necessary and the cover glass used should be somewhat larger than those ordinarily employed.

The simplest method of detecting the parasites is by the examination of fresh preparations between slide and cover glass under a low power of the microscope; in certain cases an oil-immersion lens is required combined with a dark ground illumination.

Another good method for detecting and also for counting the parasites consists in spreading a large drop of blood on a slide, allowing to dry and then getting rid of the haemoglobin by placing in distilled water. The thin grey film remaining is fixed in alcohol for a few minutes, washed and stained with haematoxylin. Before examination the smears are covered with a layer of cedar wood oil in order to increase their transparency.

The cellular structure is best made out by employing Looss's method. The cover glass is smeared with a thick layer of blood and placed wet side downwards for two or three minutes in 70 per cent. alcohol kept at 60° C. The smears may be preserved in 70 per cent. alcohol for a long time. Before staining, the preparations are put through increasing concentrations of alcohol. They are then stained with haematoxylin, dehydrated in alcohol, clarified in oil of bergamot, and mounted in Canada balsam.

Intra-vitam staining with a solution of azur II. in distilled water (1 : 3,000) is suitable for the study of the internal organs of the parasite. A drop of blood and a drop of the staining solution are mixed together on a slide and covered with a cover-glass. The microfilariae remain alive for some time but take on the colour. All these methods are surpassed by the following processes lately introduced by **Fülleborn**, viz.:—

(*a*) Azur-eosin stain. The freshly dried, not too thick, smears on cover glasses are stained for 1½–3 hours in a solution composed of 4 c.c. of alkaline 1 per cent. azur II. solution + 100 c.c. of 0·9 per cent. salt solution. The preparations are then placed in a 1 per cent. solution of eosin in a 0·9 per cent. salt solution for 10 minutes. The preparations must only be allowed to remain in the first solution until the bodies of the parasites acquire a light blue tinge.

(*b*) Carbol-methyl-green-pyronin stain. The freshly dried smears are placed for one to two minutes into 0·9 per cent. salt solution and then for half-an-hour or longer in carbol-methyl-green-pyronin (**Pappenheim-Unna**) to which one-tenth of its volume of 0·9 per cent. salt solution has been added. The preparations are then differentiated in 10 per cent. alcohol for 10 seconds, in 30 per cent. for 10 seconds, and in absolute for 20–30 seconds. They are then clarified in oil of bergamot and mounted in Canada balsam.

For counting the number of microfilariae in blood 20 cmm. is taken as a standard measure in the case of human beings, but, as the number of parasites is not generally so numerous in horses, the author used a larger quantity (100 cmm.). This quantity was sucked up into a pipette, placed on a slide and spread into an even layer by means of a knife. The preparations were dried and stained according to the method used for counting described above.

A method of concentrating the parasites consists in taking a moderately large quantity of blood from the jugular vein, defibrinating and centrifuging at a high speed for two hours or more. The microfilariae are found in the layer between the serum and the red corpuscles.

The measurements were taken by means of an ocular micrometer and an oil immersion lens. They were only approximately accurate in the case of living specimens.

The diagnosis of the parasites is made by examining fresh preparations or stained smears freed from haemoglobin. If numerous, parasites may be detected in the first smear examined but otherwise a large number (at least 10) must be repeatedly searched. In such cases the concentration process should be used.

Morphology and biology of the microfilariae.—In fresh preparations the parasite is seen as an elongated white small worm about the width of a red corpuscle and about 50 times as long. It executes very lively, snake-like movements between the corpuscles, sometimes becoming coiled into a spiral-like shape and sometimes straightening itself out. It is often difficult to keep within the field of the microscope even under a low power. The measurements can only be determined during a period of rest; the length is about 250 to 290 microns and the width 5 to 7 microns; dead parasites are always shorter owing to shrinkage. The anterior extremity is blunted and the posterior drawn out and pointed in appearance. The body is of uniform width along the part extending between the anterior tenth and the end of the third quarter of its length. The posterior quarter tapers to a fine thread-like extremity. Under a high magnification and with the use of dark ground illumination the granular body substance is seen to be surrounded by a narrow lighter zone which is the envelope representing, according to some authors, the covering of the embryo. No adhesion to the slide as seen in many other microfilariae was observed. In dried preparations freed from haemoglobin the microfilaria is seen under a low power as a thread-like coiled-up body staining dark blue; in some cases the envelope is seen to protrude in front and behind as a delicate faintly stained shred. The coiling of the body presents no special characteristics.

Dry fixation and staining with Giemsa is not suitable for showing the structure of the organism owing to shrinkage. This is better seen by the use of Looss's method; the body then generally takes up a straightened out appearance and the dark blue body is seen to be surrounded with a sheath which is easily recognisable owing to its protruding in front and behind. The body is found to consist of a large number of regularly arranged granules which are interrupted in three distinct places by transparent areas free from granules.

The stained organism is found to be shrunk so that it now measures 150 to 240 microns, the sheath protruding anteriorly by about 6 to 16 microns and posteriorly by about 20 to 40 microns. Shrinkage occurs after the employment of every method, especially after dry fixation, but least of all in FÜLLEBORN'S method. According to RODENWALDT the dark granular appearance of the body is an artefact produced owing to the strong staining affinities of the cells lining the intestinal tract thus masking the appearance of the other organs. In this granular mass of deeply stained intestinal cells only three gaps are plainly visible which represent the nervous centre or nerve ring (N.), the excretory pore (Ep.) and the genital or anal pore (Gp.).

The nerve ring is situated towards the anterior part of the body and runs across it obliquely in the form of small stripes. The excretory pore lays at the junction of the anterior and middle third of the body, and the genital pore in the posterior third of the body ; the excretory pore is larger than the genital pore ; each takes up about half the width of the organism. In order to study the finer details it is advisable to adopt intra-vitam staining or FÜLLEBORN'S method of staining and examine a considerable number of specimens—which is difficult on account of their sparsity in horses—as the complete details cannot as a rule be observed in the case of a single specimen.

Excretory organ.—Under an oil immersion lens one may observe that the stain is taken on comparatively deeply at the junction of the anterior and middle third of the body and spreads out in a backward direction. At this point is found an elongated oval, clear, vesicular-looking gap opening outwards, viz., the excretory pore. A short distance behind the pore is noticed the excretory cell (Ez.) lying in the middle line of the body and about half the width of the worm. It is of an elongated oval shape and possesses a lightly staining cytoplasm with a dark blue oval nucleus lying in its middle. The cell is surrounded with a small dark blue area which is connected with the pore by a thin stripe.

Genital organ.—The second distinctly stained place is the genital or anal pore according to RODENWALDT, but LOOSS, FÜLLEBORN, and SAISAWAS doubt the correctness of this statement. Like the excretory pore the genital pore here appears as a gap of variable size and form opening outwards. At a distance of several worm breadths towards the head lies a large cell, the principal genital cell (G_1) and at some distance between this and the genital pore lie closely together three smaller cells (G_2, G_3, G_4) applied closely to the side of the wall opposite the pore. All these cells are surrounded by a darkly stained area.

Besides the cells of the excretory and genital pores may be seen in deeply stained specimens a few very lightly staining spindle-shaped cells distributed along the whole wall of the body, but especially near the excretory pore. According to RODENWALDT these are known as the matrix cells of the sub-cuticula.

In many cases two indistinct red specks (M) can be seen near the buccal end of the parasite when stained by FÜLLEBORN'S method. These must be analogous to the red mouth structures described in some species of microfilariae.

Internal body.—Between the excretory and genital organs is sometimes seen an elongated structure about 50 microns long with a wavy outline and a little narrower than the body of the microfilaria.

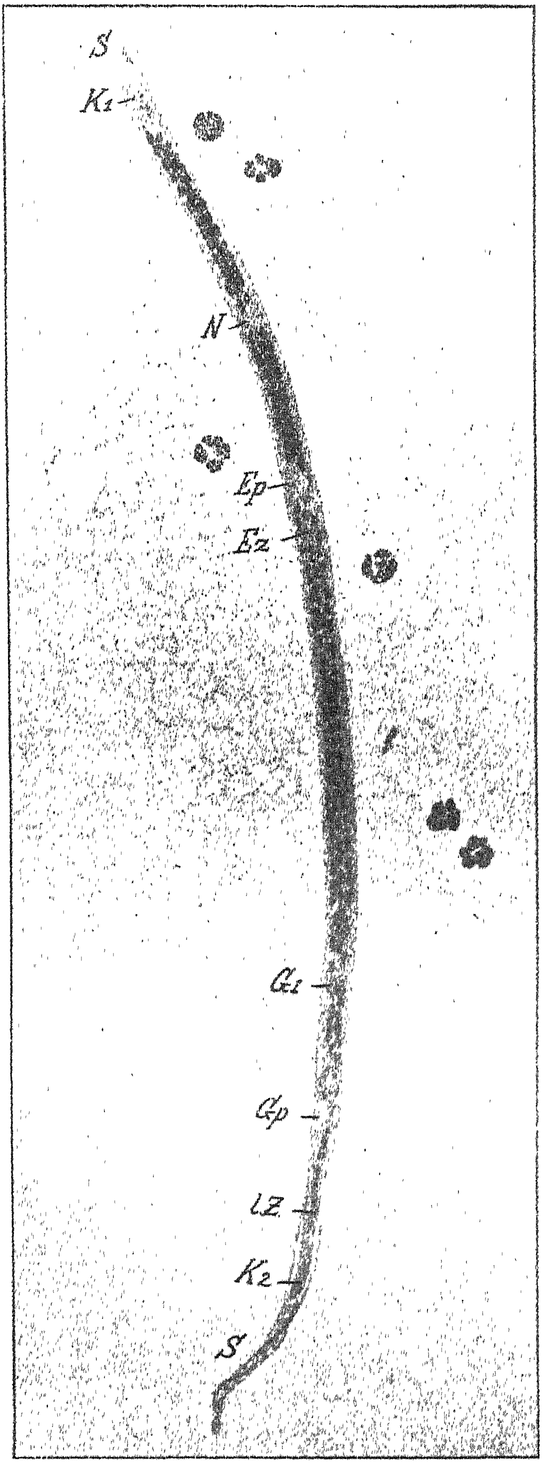

Fig. 3.—Microfilaria stained according to Looss's method. Very highly magnified. S = sheath (folded); K_1 = anterior extremity; K_2 = posterior extremity; N = nerve ring; Ep = excretory

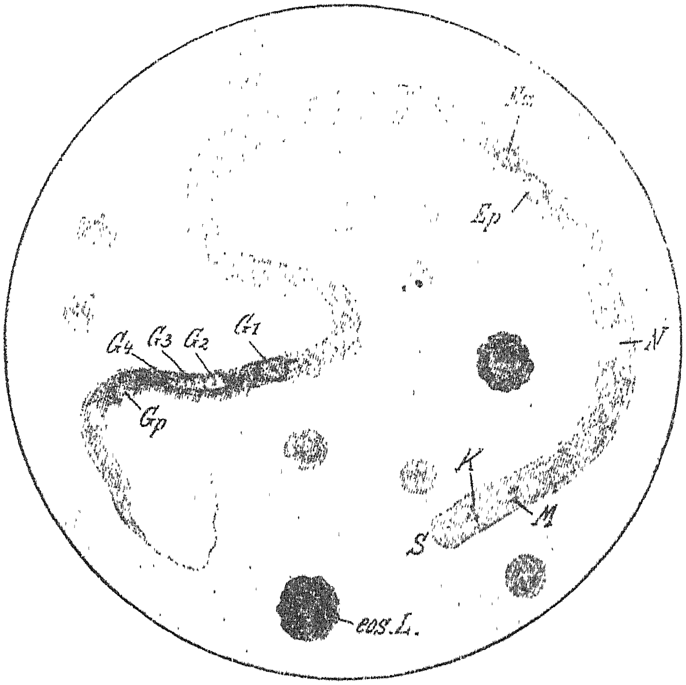

Fig. 4.=Microfilaria stained according to Fülleborn's azur-eosin method. Highly magnified. S=sheath; K=characteristic head structures; M=red mouth structures; N=nerve ring, Ep and Ez =excretory pore and cell; G_1=principal genital cell; G_2, G_3, G_4=genital cells; Gp=genital pore; eos. L=eosinophile leucocyte.

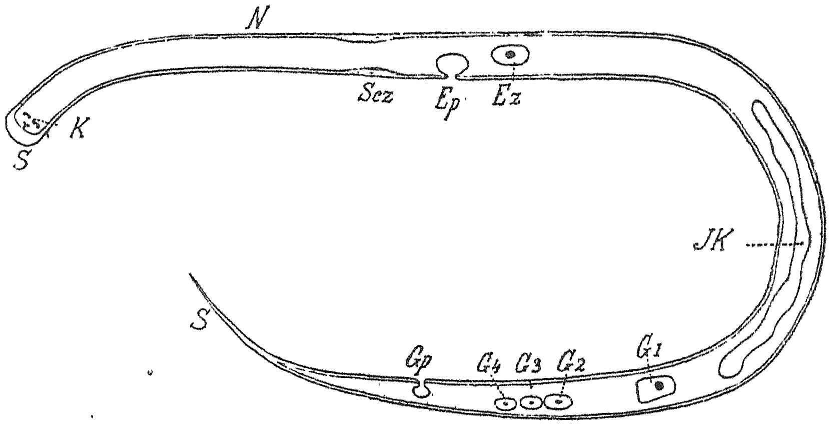

Fig. 7

Fig. 7.—Schematic structure of the microfilaria. S=sheath; N=situation of nerve ring; Scz=matrix cells of the subcuticula; K=characteristic head structures; Ep and Ez=excretory pore and cell; JK=internal body; G_1=principal genital cell; G_2, G_3, G_4=genital cells; Gp = genital pore.

It is rendered visible owing to its being less transparent than the body of the worm but its form and position are found to be continually changing. The significance of this body is not known. A short tube which is probably the gullet may sometimes be recognised.

Buccal structure.—In a fresh preparation under a high magnification one may observe at the anterior end of the parasite to the right and left of the middle line a clear refractile rod-shaped speck each apparently connected with the other. Below these two small specks may be seen still more minute but similar-looking structures. In the case of dead specimens in a preparation examined in the fresh state or stained by FÜLLEBORN's method a few will show the following structure :—The sheath overlaps the head to a greater or less extent and at the buccal end of the worm may be seen to the right and left two small dumb-bell shaped structures running transversely. Between these may be seen a third speck of similar shape. The function of these bodies is not known.

Retraction of the body within the sheath.—This phenomenon, described by various authors in the case of other microfilariae (e.g., *M. bancrofti*), was rarely seen by the author. Close observation of living specimens under a high magnification showed that the phenomenon was in reality an artefact due to a lateral observation of the extremity during a turning movement of the parasite. The author considers that this is probably the explanation of such appearance described by authors in the case of microfilariae especially of the human subject.

Differential characteristics. — Various characters used for the recognition of microfilariae have already been dealt with, viz., (1) the presence or absence of a sheath, (2) length and breadth, (3) the characteristic position in air dried preparations freed from haemoglobin, and (4) the structure of the excretory and genital organs. The fifth important point, viz., the position of the separate fixed points of the parasite relative to its length, remains to be dealt with. These positions are stated to be constant in any given species of microfilaria but they vary in different species. Tables are given showing the percentage length distribution of the fixed points and the differences between them according to the total length of the parasite, and according to the length of the column of granules in the body. The following table represents the percentage lengths from the anterior end occupied by these fixed points in the parasite of the horse, compared with those of the two common microfilariae of the dog; the lengths do not include the sheath :—

	Nerve ring.	Excretory pore.	Excretory cell.	Principal genital cell.	Genital pore.	The terminal stained body cell.
Microfilaria immitis .	22·5%	31·0%	36·8%	64·4%	77·8%	91·8%
Microfilaria repens .	20·1%	29·2%	?	63·0%	75·9%	89·9%
Microfilaria of the horse	20·4%	31·3%	34·5%	70·4%	82·5%	91·7%

Number and distribution of the microfilariae in the blood.—As mentioned above the number of parasites in the blood of affected horses is very variable. In one case it was found that the presence of 15 microfilariae could be determined in 0·1 c.c. of blood no matter where the blood was taken from. In another case where a greater number of accurate estimations was made it was found that the parasites were not equally distributed in the circulating blood if small quantities of blood are taken. If taken at quite short intervals from the same place the number of parasites in a given quantity was found to exhibit great differences. These results were obtained whether the blood was taken from the facial vein or from the jugular. The results were the same in the case of capillary blood (taken from the lip) except that here the number was as a rule smaller. The largest number of specimens counted in the blood from the facial vein was 26 and from the lip 4 per 0·1 c.c. Considerable muscular activity on the part of the animal (galloping for ¾ hour) had no influence on the number and distribution.

Periodicity of the microfilariae.—A peculiarity of certain species of microfilariae is that they appear, with a certain degree of regularity, only at certain periods of the day in the circulating blood (e.g., *Filaria loa*, which is present in large numbers in the human blood during the day, and *Filaria bancrofti*, which is present in large numbers during the night). According to LINGARD the embryos of *Filaria sanguinis equi* are found in greater numbers in the blood during the evening and such is also the case with the microfilariae described in the camel (PRICOLO). PENEL and LOOSS state that this periodicity is probably accounted for by the fact that the parasites or their sheaths are held by some product of the host's body in the lungs at certain times and then released into the general circulation. As the human microfilariae exhibiting this phenomenon are those which possess sheaths the author carried out experiments in order to determine whether the same applied to the equine organisms. The number of parasites was thus counted during a number of days at intervals of three hours throughout the day in each case; blood was taken from the facial vein and from the lip. As the number of organisms in the blood may be very variable when samples of blood are taken at the same time from the same place the periodicity counting could only be of value if similar results were repeatedly obtained. However, as the result of these determinations it could not be stated that there was any evidence as to the existence of periodicity, although at 6 a.m. the largest (total 61) and at 6 p.m. the smallest (total 22) in seven countings was found.

Seasonal maximum.—In the author's experience the microfilariae were found most plentifully during the hotter part of the year. According to BAHNMÜLLER's experiments the parasites were found in 24 horses in summer whereas they could only be found in two horses during the following February.

Distribution in the organs.—From the results of tests on man and dogs microfilariae are present in far larger numbers in the capillaries of the internal organs, especially of the lungs, than in the peripheral blood. In the case of the parasite dealt with by the author it was found that far more specimens could be obtained after death of the horse from the spleen than from the peripheral vessels or other organs. Blood on one occasion extracted from the lungs during life did not show an unusually large number of parasites. The number found in peripheral capillary blood (lip blood) was always smaller than in the larger peripheral blood vessels.

Histological changes in filariasis.—The tissue surrounding the parasites shows no changes. In sections from various organs a few single specimens can be found in the capillaries and their presence can only be revealed under a high magnification.

Resistance of the microfilariae.—Numerous tests have shown that various microfilariae are endowed with considerable vitality. According to the author's experiments the parasites show great activity in blood outside the body but their movements gradually diminish. In fresh cover-glass preparations they remained alive for 24 hours and in defibrinated blood they were still motile after 48 hours when the blood was kept in a test tube at room temperature or in the refrigerator. In the incubator at body temperature they did not live so long. The parasites in defibrinated blood pass easily through ordinary filter paper. When dried in a thin layer on a slide they die in two minutes; desiccation seems to be most effective in killing the parasites. Addition of distilled water to a preparation on a slide brings about a gradual dying off; their movements at first are very active but after five minutes they become somewhat slower and in about 30 minutes they cease completely. In artificial gastric juice (0·1% HCl) and pancreatic juice they die off very quickly. Addition of neosalvarsan solutions (1 to 1,000 up to 1 to 100) produces the same effect on the organisms as distilled water. Their viability in the circulating blood is not known but is probably rather long (some weeks or months).

The adult stage of the microfilaria.—This microfilaria has been regarded for some time as the embryonic stage of *Filaria papillosa*; no conclusive evidence in support of this opinion has however been produced. The problem was elucidated by the author by post-mortem examination of the affected horse described above. In the peritoneal cavity were found 10 specimens of *Filaria papillosa*, viz., seven females and three males. These were all lying on the small intestine and diaphragm. All the other organs especially the large blood vessels, skin, and connective tissue were searched for filariae without result. All the organs presented a normal appearance with the exception of the spleen; this organ was distinctly enlarged, the edges were blunt and the pulp was rather firmer than normal and of a dark red colour. More microfilariae were found in the spleen than in the other organs. There were fibrinous adhesions between the spleen, liver and diaphragm.

Some of these adult filariae were placed at once in normal saline solution or in horse serum and others were fixed in hot 70 per cent. alcohol for a few minutes and then kept in this solution. Microfilaria preparations were made in the following way: about 1 to 2 cm. of the caudal extremity of the female filaria was cut off and the contents of its body squeezed out on to a slide. The preparation was then examined in the fresh state after the addition of 2 per cent. acetic acid. It was then seen that the embryos from *Filaria papillosa* possessed a sheath and that the relative measurements and buccal structure corresponded with those seen in fresh preparations of the microfilariae from the blood. The length of the organisms freshly obtained from the adult parasites or kept in serum was about 240 to 300 microns by from 6 to 7 microns broad. Those obtained from adults preserved in alcohol were found to have shrunk to about 225 to 265 microns long by 5·8 to 6·9 microns broad. The embryos obtained from the adult worms were stained after wet fixation in hot alcohol as above according to FÜLLEBORN's azur II method without drying. Staining presented considerable difficulty. The excess of stain was sucked off by means of filter paper. The examination was begun at once but the desired depth of staining was only obtained after some time. After employing this method single specimens of the embryos were seen to exhibit the same characteristics as those of the blood parasites, especially with regard to the distribution of the cells in the genital organs and the percentage location of the fixed points along the length.

The cause of filariasis in the horse would thus be *Filaria papillosa* and the microfilaria present in the blood is *M. papillosa*.

Considering the frequent occurrence of *Filaria papillosa* in Hungarian horses (according to FIEBIGER about 30 per cent. of all horses harbour these worms) it seems strange that the microfilariae were not discovered much earlier and much more commonly. This can be explained by the fact that a systematic blood examination in cases of filariasis was not often performed and that the number of microfilariae is either very small or they may have disappeared from the blood. That the microfilariae are not so rare as is supposed was found in the examination of the military stud above referred to, although only a few preparations were taken from each horse; and, lastly, it must be remembered that microfilariae only occurred in the blood when sexually mature females and male elements are present in the body. The author mentions an outbreak of microfilariasis occurring in the summer of 1915 at Koniggratz; one horse died of pyaemia and *F. papillosa* was found in its peritoneal cavity. The simultaneous discovery of microfilariae in the blood and *Filaria papillosa* in the abdominal cavity can be traced back as far as 1848 (WEDL) in Vienna. SONSINO (1876) in Egypt made a similar discovery. DEUPSER (1892) reported that the embryos of *F. papillosa* only remained alive for a few hours in water or salt solution while in the blood they lived for 36 hours, showing that the blood is their natural habitat. The same author placed a pregnant female *Filaria papillosa* in the peritoneal cavity of a rabbit and 14 days later microfilariae were discovered in the blood. The same experiment was repeated by the author, however, without result. Lately YAKIMOFF and his fellow workers (1914–1915) have reported microfilariae in the blood of several horses in Turkestan and consider them to be most likely the embryos of *F. papillosa*.

Development of Microfilaria papillosa.—No experiments in this connection have been made but there is no reason to think that it is different from that of *F. immitis* of the dog and *F. loa* and *F. bancrofti* of human beings. As the result of FÜLLEBORN's* experiments it was

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* [Wirth does not seem to have rendered a correct historical appreciation of the researches on the subject of filariasis. In this connection we reproduce a paragraph from an article recently written by Sir Patrick MANSON on "Tropical Medicine and Hygiene" (*Brit. Med. Jl.*, 1917. July 28 No. 2952. p. 107):—

"In 1872 Timothy Lewis, in India, ascertained that the larval filaria discovered by Demarquay and Wucherer in pathological fluids was found that mosquitoes and other biting flies ingested the microfilariae by sucking blood from an infected animal; after wandering through the body of the intermediate host the parasites are set free from the proboscis and then possess the power of boring through sound skin and entering into the internal organs. Here the parasite reaches sexual maturity and produces a large number of microfilariae which find their way into the blood stream. The intermediate host in Hungary is not known. Direct injections of microfilariae into the blood have hitherto failed to infect. A comparison is drawn between filariasis in man and in horses. In the former case the symptoms and lesions are more especially of a local nature (lymphangitis, etc.) whereas in the horse general symptoms are produced (dullness, sudden collapse, etc.). In the case of man the lesions are set up mostly by the adult worms or their products whereas in the horse it would appear that the symptoms are set up by the microfilariae. From a study of the literature it appears possible that other species of filariae may cause the appearance of microfilariae in the blood. It is only from MANDEL's description (1911) that one can ascertain that *Microfilaria papillosa* was probably being dealt with, whilst other authors might have described other unidentified species of microfilariae.

VAN SACEGHEM (R.). **Contribution à l'étude de la dermite granuleuse des Equidés.** [Granular Dermatitis of Equines.]—*Bull. Soc. Path. Exot.* 1917. Oct. Vol. 10. No. 8. pp. 726–729.

In this paper the author summarises some observations he has made on the above disease as it occurs in equines at Zambi, Lower Congo. A brief reference is made to the literature incriminating a nematode worm as the cause of the disease.

RIVOLTA (1868) described the occurrence in the lesions of a filarial worm which he named *Dermatofilaria irritans*, a name afterwards changed by RAILLIET into *Filaria irritans*. Recently RAILLIET has pointed out the great morphological similarity existing between the parasites found in summer sores of the horse and the larvae of Spiroptera [see this *Bulletin*, 1916, Vol. 4, No. 3, p. 102]. One of the characteristics of this larva is the blunt posterior extremity

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normally a parasite of the circulation. He called it *Filaria sanguinis hominis*. In 1876 Bancroft, in Australia, discovered the parental worm, *Filaria bancrofti*. Subsequently, in 1878, the writer ascertained that a Culex mosquito served as its intermediary host, abstracting the microfilaria from the blood and providing it with an opportunity for undergoing important developmental changes, during which it increases in size from a microscopic object to one just visible to the naked eye, and possessing an alimentary canal as well as remarkable powers of locomotion. In 1900 Low, at the London School of Tropical Medicine, and subsequently James in India, made the important discovery that at this stage of development the larval worm passes into the labium of the mosquito's proboscis, and gets back into man direct, the old idea of the mosquito dying on the water and the embryos escaping into this medium and so reaching man, being thereby, if not absolutely disproved, rendered improbable. Noè, Grassi, and Fülleborn in the case of the allied parasite (*Filaria immitis*) of the dog, and Bahr in the case of the human parasite, have shown the exact mechanism of how this takes place. Finally, the metamorphosed embryos arrive at the lymphatics, where development is completed and the new generation of embryo filariae born."—ED.]

studded with bristles: RIVOLTA'S Dermatofilaria possesses the same peculiarity and one is thus led to conclude that the nematode of summer sores is in fact a Spiroptera larva.

Three species of Spiroptera infesting equines are known, viz., *Habronema megastoma* Rud., *H. microstoma* Schneider, and *H. muscae* Carter. *H. megastoma* can be found in the adenomatous looking tumours in the stomach of the horse and ass while the other two species live within the stomachs of equines. The evolution of the larvae of *H. megastoma* and *H. microstoma* is not known but RANSOM has worked out the various stages in the development of *H. muscae*. The embryos of this worm, which lives in the adult stage in the stomach of the horse, are evacuated with the faeces and penetrate within the larvae of flies which live on the manure. In these larvae of flies the pupae and the adult worms are evolved. These finally regain access to the stomach of the horse, probably, according to RAILLIET, when the flies alight on the moist lips of this animal or even more probably when they are ingested.

According to Van Saceghem's observations granular dermatitis occurs only in animals kept in stables; in these stables the bedding was changed and the dung removed regularly. The disease is never localised in the hind quarters but always in the fore quarters, on the legs, and at the inner canthus of the eye; lesions in other situations are rare. Equines which are allowed to live at liberty never present the disease; they usually pass the night in a place where the dung is never removed, but in the morning they leave in order to graze freely in the jungle. These facts would tend to show that the infection is not transmitted directly by means of the faeces and that flies should be held to convey the disease. If the parasite was derived directly from the dung the horses remaining all night on heaps of manure would be the ones more especially affected, and also the hind quarters would be more susceptible to infection. On the other hand, the common house flies and Stomoxys are common in the stables whereas they are rare in the jungle. The reason for the absence of infection of the hind quarters would be explained by the fact that flies are beaten away from this region by means of the undocked tail of the animal.

In a stable where several horses were affected with summer sores the author found that 20 per cent. of the common house flies were infested with a nematode larva 2·5 mm. long by 65μ broad. This larva possessed an elongated, pointed, anterior extremity and a blunt posterior end studded with bristles. The mouth communicated with a passage followed by the oesophagus, the two latter portions measuring together ·85 mm. From 3 to 5 specimens of this larva could sometimes be found in the proboscis of the fly. In normal saline solution under the microscope these larvae show very active forcible movements and penetrate within obstacles.

The above larvae found in the fly were found to differ from those found in summer sores inasmuch as the former were 65μ broad and showed no longitudinal striation whereas the latter were 50μ broad and showed marked longitudinal striation. Larvae taken from a fly and placed on the skin of a guinea-pig moistened with normal saline showed very active translatory movements but no tendency to penetrate the skin. When the moisture had been sucked up with blotting paper the larvae remained stationary and died. These experiments were, however, made during a time of the year when all summer sores show a natural tendency to healing. It is believed that the larva found in the domestic fly at Zambi is the larva of *H. muscae.* No specimens of *H. megastoma* were found in a few post-mortem examinations recently made at Zambi.

Summer sores usually reveal a large number of calcified parasites and a few living ones. There is thus a massive infection at a single point. It is not very probable that these larvae are all conveyed during one short period of time to this same point. It is more probable that certain sites show a predisposition, such as occurs on wounds with a moist surface. In the case of the inner canthus of the eye this predisposition always exists whereas in the case of the limbs there must be a pre-existing wound. If an infected fly alights on the wound the larvae penetrate and set up a pruritus similar to that described by Looss (1898) in the case of the larvae of *Ancylostoma duodenale* during their passage through the human skin. This irritation will cause the animals to bite the infected place and the large sore thus produced would further attract flies and set up a most suitable point of entry for the parasites. The author often observed that on the part of the body where a summer sore was subsequently set up an intense pruritus was manifested before the appearance of visible lesions. Further experiments on this subject are in progress.

DICKINSON (Campbell G.) & HILL (Gerald F.). **Investigations into the Cause of Worm Nodules (*Onchocerca gibsoni*) in Cattle.**— Commonwealth of Australia. Published under the authority of the Minister for Trade and Customs. 7 pp. Melbourne: Albert J. Mullett. Government Printer.

In this short paper Dickinson and Hill briefly describe a small series of experiments conducted by them at Darwin in the Northern Territory of Australia. These were commenced by MCEACHRAN and Hill in 1914 for the purpose of determining the nature of the intermediate hosts of *Onchocerca gibsoni.* In these preliminary experiments it was shown that calves placed in screened and open pens thirty yards from infected cattle did not become infected whilst in the case of calves, both Victorian and locally bred, grazing with an infected dairy herd definite nodules were discoverable on post-mortem examination, indicating that infection had taken place. These experiments were conducted during the period January to July and August, and it was decided to carry out further experiments on the same lines, but during the period July or August to January or February.

Six female calves 6 months old were imported from Victoria and on arrival at the laboratory were divided into three lots of two calves each. The first lot was placed in a screened pen enclosed with fine brass wire gauze and entrance to it was through a porch with double doors. The pen was cleansed and whitewashed and the concrete floors repaired before being used. A second lot was placed in an open pen; the third lot was allowed to run free in a paddock with three infected local cows. A three months old control calf, locally bred, was also placed in the paddock with the cows. Throughout these experiments the calves kept in both pens were fed on fodder imported from Victoria and no locally grown material was used as bedding. The other calves running in the paddock with infected cattle had their grass feed supplemented by locally grown rice chaff and the only drinking water used by them was obtained from a bored well 116 feet deep. The paddock was situated on high ground so as to prevent the calves coming in contact with swampy land; it was tick infested and the calves had to be treated periodically in order to destroy the ticks. During February, seven months after their arrival, a series of early morning observations of the calves were made with the object of discovering a possible ground-living vector that might bite the calf whilst lying down but drop off as soon as the calf rose from the ground. Searches were also made of the patches of ground on which the calves had lain but on no occasion was any possible parasite found.

In March 1916, that is, about eight months after arrival into the Territory the imported calves running out at pasture were slaughtered and in one case two small nodules about the size of a pea were found on the brisket and in the other case one small nodule about the size of a split-pea on the right side of the chest. The control calf, killed two months later, also showed one nodule about $\frac{3}{4}$ by $\frac{1}{2}$ inch on the right side of the chest. This experiment thus confirms the finding of McEachran and Hill that calves reared in the vicinity of the experimental pen and allowed to graze with infected cattle become themselves infected, as also do imported calves from a nodule-free State living under the same conditions. Further, as these calves were confined to a high well-drained paddock up to within a week of slaughter the infection could not be carried by a purely aquatic animal, it being very improbable that these could be found in the deep well water.

In the case of the two calves placed in the open pen in July 1915 the infected cattle grazing in the paddock were allowed to come up to 30 yards of the pen. From the latter part of November till the date of slaughter these calves were exposed to the attack of biting flies and were frequently bitten by *Tabanus mastersi* Walk., *Tabanus nigritarsis* Taylor, *Stomoxys calcitrans* Linn., and *Lyperosia exigua* de Meij. Flies of the last-named species were very troublesome to these calves in February and March, causing characteristic sores on the brisket, under the throat, and at the inner canthi of the eyes. It is almost certain that they were bitten also by several species of Culicidae and probably by sand flies. Buffalo lice (*Haematopinus tuberculatus* Burn) which were found on calves occupying this pen during the former series of experiments could not be found during the period July 1915 to April 1916. On the other hand ticks, *Boophilus australis* Fuller, which were not found on any of the calves used by McEachran and Hill, were rather numerous on both calves throughout the period of these experiments necessitating the use of dipping fluid on several occasions. These calves were slaughtered about eight months after arrival and on post-mortem examination negative results were obtained in both cases. The authors note, however, that certain species of Tabanidae, notably *Tabanus rufinotatus* Bigot, and *Tabanus cinerescens* Maclay, rarely, if ever, attack stock under a roof.

The two calves placed in the screened pen and kept free from the attacks of biting insects and ticks throughout the course of the experiment were slaughtered also about eight months after arrival, and on post-mortem examination negative results were obtained.

The authors thus summarise their experiments:—

> "(1) Calves from a nodule-free State become infected within 8 months of their arrival in the laboratory when grazing on high ground along with infected cattle.
>
> "(2) Calves from a nodule-free State did not become infected during the same period when enclosed in an open pen with concrete floor within 30 yards of a paddock within which affected cattle were depastured although exposed to the attacks of winged and apterous *Arthropoda*.
>
> "(3) In view of the post-mortem findings in experiment No. 2 (open pen) negative results were to be expected in experiment No. 3 (screened pen) in which calves were protected from the attacks of the same *Arthropoda* by fly-proof netting."

The authors, moreover, consider that although the experiments did not lead to the discovery of an intermediate host of the parasite causing onchocerciasis in cattle they definitely excluded the species of flies and tick mentioned above, and also any purely aquatic forms other than those possibly found in the bore water.

A list of the blood-sucking Arthropoda which have been recorded in the vicinity of the experimental laboratory at Fannie Bay is appended.

During the period April to June 1916 six aged and two young wild swamp buffaloes which were shot in the vicinity of Darwin were examined for worm nodules with negative results. Wild zebu cattle and domestic cattle grazing on the same country are invariably infected, the former apparently more heavily than the latter. From one heavily infected zebu bull a well-developed and typical nodule was removed from the tissues under the skin 8 inches behind the junction of the last sternal rib with the sternum and 12 inches from the median line of the belly. In none of their examinations of zebu and domestic cattle were the authors able to discover *O. gibsoni* behind the femoro-tibial joint.

CONREUR (Charles) & URBAIN (Gaston). **Enterite hemorrhagica dos cães novos—Uncinariose intestinal.** [Haemorrhagic Enteritis of Young Dogs, due to Uncinariasis.]—*Arch. Brasileiros de Med.* 1916. Oct. Vol. 6. No. 10. pp. 560–563.

The authors describe a disease of puppies, due to the presence in the intestine of *Uncinaria stenocephala*, which is very prevalent in Rio de Janeiro, and forms a serious hindrance to the breeding of sporting and other pure-bred dogs. Older dogs appear to be immune, but to puppies of an age between two and six months the disease is very fatal. The symptoms begin with abdominal tenderness and bloody diarrhoea, the nature of the excreta showing that the blood comes from the small intestine. There are also symptoms of gastritis, indicated by thirst, nausea and vomiting, the vomit consisting of alimentary substances mixed with mucus and blood. The temperature rises to 40°–41° C. The pallor of the mucous membranes indicates rapid anaemia. Epileptiform attacks sometimes follow, and the animal usually dies in three or four days. Post-mortem, marked anaemia is to be observed of all the organs, while the stomach is empty and the mucous membrane of the small intestine shows haemorrhagic infiltration. Microscopic examination of its contents reveals the presence of numerous small nematodes, generally associated with tapeworms and ascarides, and ova. The worm is from 6 to 10 millimetres in length.

The disease is not to be confounded with the pernicious anaemia caused by *Ancylostoma tubaeforme* which occurs in older dogs, or with the epizootic gastro-enteritis of Stuttgart. Treatment with vermifuges has very little beneficial effect owing to the acuteness of the symptoms.*

FERRARO (Giuseppe). **I Ditteri ematofaghi della Colonia Eritrea incriminati della trasmissione delle tripanosomiasi locali.** [The Blood-Sucking Diptera of Eritrea incriminated with the Transmission of Local Trypanosomiases.]—*Clinica Vet.* 1917. Sept. 15–30. Vol. 40. Nos. 17–18. pp. 487–493.

Since the discovery of trypanosomiasis in dromedaries in the above-named Italian colony by PRICOLO (1912) the author set to work to study the nature, distribution, and mode of transmission of this disease. He found that a number of flies indicated by the natives as transmitting agents proved to be non-biting harmless species. The following list of diptera, identified by BEZZI, is given of the flies which can be safely incriminated as disease carriers :—

Muscidae : *Stomoxys taeniata* Bigot, *S. sitiens* Rondani.

Tabanidae : *Pangonia beckeri* Bezzi, *Tabanus obbliquemaculatus* Macquart (= *leucostomus* Loew, or *ruficipes* Bigot.), *T. pallidi acies,* Surcouf, *T. gratus* Loew, *T. cordieri* Surcouf, *Pangonia magretti,* Bezzi, *Haematopota abyssinica* Surcouf.

All the above are tropical species and to them must be added *Tabanus sufis* Jeannicke, which has apparently been found also in Morocco, and *Hippobosca maculata,* which is found throughout Southern Asia and in Upper Egypt. The two Pangonia species mentioned are only found in Abyssinia and neighbouring regions. *T. obbliquemaculatus* appears to be the most widespread species in the colony ; it is also known in a large part of tropical and sub-tropical East Africa. No Glossina was discoverable.

According to PRICOLO's observations the trypanosomiasis observed in camels in Tripoli in 1912 was not an indigenous disease inasmuch as it occurred only in imported camels and did not spread to other camels or other species of animals. This may depend on the fact that the above-mentioned tropical blood-sucking flies do not extend further north than latitude 20° N.

The above-mentioned species are also blamed for the transmission of bovine trypanosomiasis. The camel disease, however, appears to have a much more widespread distribution than that of bovines inasmuch as the former is indistinguishable from other African trypanosomiases known as *mbori* and *el debab* and also from surra, whereas the latter is a more localised disease probably spread by the local species such as Haematopota. The native names of certain biting flies are given.

The author then describes at some length the relationship between the humidity of the atmosphere, depending on the seasons and the altitude of the districts, and the frequency of blood-sucking flies ; the season during which most rainfall occurs varies considerably in Eritrea according to the altitude of the districts. Experience shows that great losses have been caused among camels especially during military campaigns when they are taken into the humid belts.

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*Summarised by Dr. J. B. NIAS.

BACTERIAL DISEASES.

HARDENBERGH (J. B.) & BOERNER, Jr. (Fred). **Hemorrhagic Septicemia in Mules.**—*Jl. Amer. Vet. Med. Assoc.* 1917. Sept. Vol. 51. (New Series Vol. 4). No. 6. pp. 817–822.

Organisms of the fowl cholera type have been incriminated with the causation of equine affections by a number of authors. It is recalled that LIGNIÈRES (1897) and others discovered organisms belonging to this group in the blood and exudates from cases of equine influenza, but more recent work indicates that this disease is most probably due to a filterable virus. WEBB (1907) in India described an outbreak of haemorrhagic septicaemia in young mules similar to the one described by the authors; microscopical examination of the blood revealed a rich culture of bipolar organisms but as the examination was not made until about eight hours after death he did not feel justified in concluding that these organisms were the primary cause of the disease. Two years later the same author also reported outbreaks among young horses and donkeys due to a similar organism and characterised by an acute and fatal pneumonia. GILLETTE (1912), also in India, described the case of a horse which showed symptoms and post-mortem lesions of haemorrhagic septicaemia; smears from the heart blood showed a small number of organisms of the above type while those from the intestinal exudate showed them in large numbers and apparently in pure culture.

In August 1916 Hardenbergh and Boerner investigated an outbreak of haemorrhagic septicaemia in young mules in Pennsylvania. Five yearling mules were reported to have died suddenly in the affected centre within 24 hours after showing the first symptoms. Post-mortem examination of two of these cases revealed marked icterus, a sero-gelatinous infiltration of the subcutaneous connective tissue, lymphatic glands haemorrhagic and oedematous, congestion of the lungs, petechiae on the serous and mucous membranes, and slight enlargement of the spleen. The diagnosis was thus based on the fact that the lesions were identical with those observed in the acute form of the disease in cattle, without the presence of pneumonia or any other condition to indicate that the lesions were of a secondary nature. The heart blood and tissue fluids were found to contain large numbers of typical bi-polar staining organisms of the fowl cholera type uniformly distributed and in pure culture. These were readily isolated on culture media and showed the growth characteristic of this group. Inoculation of cultures into rabbits and guinea-pigs gave negative results. Similar results had previously been obtained by Boerner in working with strains of bi-polar organisms isolated from a virulent outbreak of influenza.

The other animals kept in the same stable, including three horses over 12 years old and one mule over five years old, appeared perfectly normal at the time of the outbreak. The authors were unable to determine the source of the infection. The animals were stable fed and their food consisted of hay and oats of rather a poor quality. Cultural and animal inoculation tests with feeding and drinking material gave negative results, but as it had been found that the organism was avirulent for the small laboratory animals these tests did not necessarily eliminate these materials as sources of infection.

WATSON (E. A.). **Report on Ulcerative Cellulitis—Ulcerous Lymphangitis.** *Vet. Jl.* 1917. Nov. Vol. 73. No. 11. pp. 382–396.

This report, issued by the officer in charge of a Bacteriological Laboratory of the Army Veterinary Corps in France, deals with a condition termed "ulcerative cellulitis" by the British Army Veterinary Service. The author claims to have established "on the clearest bacteriological evidence" that this disease is identical with that better known as ulcerous lymphangitis (*la lymphangite ulcreuse* of NOCARD).

It appears that these names are often believed to designate separate morbid entities, this misconception arising owing to a lack of knowledge concerning the symptoms and lesions set up by "varieties" of the Preisz-Nocard bacillus.

In the Army Veterinary Service "ulcerative cellulitis" is held by certain observers to be different from "ulcerous lymphangitis" inasmuch as the lymphatic glands are not involved in the former condition; Watson shows that this idea is erroneous as the standard descriptions of "ulcerous lymphangitis" clearly point out that no distinct lesions are observable in the lymphatic glands.

A systematic description is given of the causal organism together with the symptoms and lesions produced by it. This contains very little that is new. The author omits to give even a brief review of the literature written in connection with the disease under consideration and the characters displayed by the so-called "varieties" of the Preisz-Nocard bacillus.

In some passages the author fails to reveal a capacity for clear argument such as might be expected in a scientific article, for example: "Finally, it is probable that many causes [cases ?] of simple wound infections and abscesses arising from punctures of the skin—due to one or another of the varieties of pyogenic diplo-, staphylo- or streptococcus—are mistaken for 'ulcerative cellulitis.' Such infections may and do not infrequently occur in the disease under discussion, but then they are secondary and not causative factors."

The most important matter discussed deals with the so-called "vaccin therapy" of the disease. The vaccine used in this treatment is made from a surface-agar growth of several strains of the Preisz-Nocard bacillus. This growth is emulsified in salt solution and washed by centrifugation. The sediment is treated with equal parts of alcohol and ether, or pure acetone, which is then evaporated. The object of this process apparently is to obtain certain quantities by weight of the bacteria. The stock vaccine consists of 1 per cent. of these dried bacteria in a sterile glycerinised carbolised saline solution. This is steamed for 2 minutes and again diluted with an equal volume of the same diluting fluid. The author states that the doses and frequency of injection have been worked out by many trials and experiments, and the system of vaccine treatment recommended is based on the results obtained.

[It is much to be regretted that an outline of these experiments has not been published as one would have then been better able to appreciate their value.—ED.]

Vaccine treatment commenced at the onset of the disease is stated to result usually in a cure within a month.

When the specific infection is quite recent and localised one should begin with a 1 c.c. dose increasing by 0·5 c.c. for each subsequent dose at seven days' interval over a period of four weeks. When the disease is well-established, chronic, or recurrent one should begin with a dose of 2·0 c.c., increasing the dose by 0·5 c.c. in the same way until five doses have been given at weekly intervals; finally a dose of 5 c.c. is given after a further seven days.

The reactions are entirely local. Thermal and general reactions are slight or altogether absent. The vaccine method of treatment is contra-indicated in cases of marked debility. In chronic cases or where secondary infections with staphylococci and streptococci exist a dose of polyvalent vaccine may be given in the intervals between inoculation of the vaccine prepared from the Preisz-Nocard bacillus. It is essential that the horse should be well exercised during the whole course of the treatment. The local treatment of ulcers and abscesses should consist of frequent irrigation with normal saline solution.

A brief description is then given of some preliminary experiments with the vaccine method of treatment. In one series designated "vaccination after infection" two horses were inoculated under the skin of the fetlock with a virulent culture of the Preisz-Nocard bacillus, and vaccine treatment commenced on the 10th and 13th day in the case of each horse, respectively. The lesions which had been set up healed completely. No control animals were used.

In another series headed "vaccination before infection" two horses were given injections of the vaccine and then inoculated subcutaneously with virulent culture. Very small abscesses resulted which healed up rapidly. No controls were again used.

Between March and the end of July 1917 over 6,000 doses of vaccine made from the Preisz-Nocard bacillus were issued, and an approximately equal number of doses of the polyvalent mixed vaccine.

A summary of the results of the treatment is given in the case of 350 horses in a table and of this number 57·6 per cent. were discharged as "cured." It is claimed that the percentage would have been undoubtedly higher if a number of horses under treatment had not been disposed of for various other reasons. [It would have been of great help if the author had indicated what in his opinion is the average percentage of cures in untreated cases or in cases treated by other methods.]

According to the author "the officers who have carried out the above treatment after a previous experience of surgical and antiseptic methods, often the most heroic, speak unhesitatingly in favour of vaccination."

[It is, of course, common knowledge that opinions thus derived from clinical experience are liable to grave error when not accompanied by statistics giving the comparative results of treatment by other methods.

Although no previous work on the employment of this line of treatment is referred to by the author the method is not new. It was tried recently by MONTGOMERY in British East Africa (see this *Bulletin*, Vol. 5, No. 1, p. 64) and by TRUCHE in the case of French army horses (see this *Bulletin*, Vol. 5, No. 3, p. 187).—ED.].

DISEASES DUE TO FILTERABLE VIRUSES.

SOHNS (J. C. F.) & SOETEDJO (Raden). **Infectieuze Anaemie der Paarden.** [Equine Infectious Anaemia.]—*Veeartsenijkundige Bladen v. Nederl.-Indië.* 1917. Vol. 29. No. 2. pp. 141–174. With 2 tables.

In August 1916 the Dutch East Indies Veterinary Laboratory was requested to investigate a sudden outbreak of disease among imported Australian horses. These horses showed disturbances in connection with the nervous and locomotor systems, especially of the hind limbs, which gradually progressed until the horses became useless and dangerous for riding. The disease was at first suspected to arise in connection with the central nervous system. The first animal examined was a 15 year old mare which was unable to lay down, often sleeping standing and falling down, and then unable to get up without assistance. At work it walked with outstretched neck and drooping head and when let loose in a field it circled to the left and had great difficulty in turning to the right. After slaughter a slight degree of hydrocephalus externus was discoverable but otherwise the central nervous system presented nothing abnormal.

The second case was a nine year old Australian mare affected at work with paresis of the right hind leg while the loins and croup were more or less hypersensitive. At times the animal could take a few normal steps with the lame leg and from time to time the lameness shifted to the left leg. Dyspnoea set in readily after slight exertion. The appetite was fairly good. No abnormality in connection with the central nervous system was again discoverable on slaughter; a rabbit injected with sub-dural fluid remained healthy.

The third case was an Australian mare bought in for a nominal sum on account of ataxic movements. The animal was in very poor condition in spite of its good appetite; the lameness was seen to affect one of the hind legs and then suddenly the affected limb became more or less sound while lameness appeared in the opposite limb. The forelegs then became so stiff that the animal was crippled in all four legs and towards the end it walked crookedly to the right or to the left. Finally, the mare was unable to get up without assistance, and after walking a few steps sweated profusely; the breathing became very rapid. The case was diagnosed as osteoporosis. On slaughter the muscles were friable and paler than normal; the kidney showed a few dark solid masses about the size of pigeons' eggs. The backbone was broken in falling; the bones of the limbs were easily sawn through. In the femora and humeri normal yellow marrow was only found in the distal epiphyses; otherwise the spongiosa contained a brownish-red substance, while the fat in the large bone cavities was of a brownish-yellow colour and semi-transparent; the interior of the fat contained dark red centres of varying size. The compact bone had become very thin while the spongy bone was enlarged pointing to a process of rarefying ostitis. Smears from the blood showed anaemic changes; the bone marrow, however, showed nothing special. Inoculation of small experimental animals and culture media gave negative results. The osteomyelitis, firm centres in the spleen, and degeneration of the skeletal muscles aroused the suspicion of infectious anaemia.

In order to confirm the diagnosis the authors injected an Australian horse with 190 c.c. of defibrinated blood from one of the above cases, while another horse received an injection of 40 c.c. of filtrate obtained by passing the defibrinated blood from another patient through a Chamberland filter. After 33 days both inoculated horses showed a rise in temperature and a few days later locomotory disturbances in the forelegs. The horse inoculated with the filtrate then suddenly showed paresis in the hind legs.

Native horses were shown to be equally susceptible; four of these animals were infected with blood from the same animals as the Australian horses were inoculated with. The symptoms were less apparent in the Java horses owing probably to the shortness of the limbs but the loss in weight was very noticeable and also the intermittent pulse.

The authors then enter into a detailed discussion of the history, distribution, etiology, probable modes of infection, pathogenesis, together with the symptomatology, morbid anatomy and diagnosis of the disease in the usually described so-called acute, sub-acute, and chronic forms. It is suggested that the name "infectious osteomyelitis" of horses would be more appropriate for the disease, which is thus defined as "an infectious disease of equines caused by a filterable virus, and which develops as an acute or more or less chronic septicaemia, and presents a clinical picture displaying most strikingly a series of ill-defined lamenesses usually connected with acute or chronic anaemia."

With regard to the mode of transmission the Japanese Commission was led to believe that this took place principally by means of flies, although experiments in this connection proved negative. According to the authors horses became infected at Buitenzorg in fly-free stables and thus infection could only have taken place through the eating of straw soiled with urine. The straw was taken out in the morning, dried and cleaned and taken back into the boxes at mid-day. Horses doing no work were addicted to eating their bedding consisting of rice straw, which is very appetising. The authors admit the possibility of infection by means of Tabanidae although natural infection in the Dutch East Indies probably occurs chiefly through eating soiled straw. The presence of the infectious material in milk is also a source of infection in foals.

In 1910 a fatal outbreak among foals showed peculiarities which pointed to the acute form of the disease. The foals presented unsteady gait, stupor, frequent pulse and loud heart beats, a yellowish discharge of saliva, loss of appetite, high temperature and frequent dyspnoea; the urine was cloudy and contained a large quantity of albumin. Post-mortem examination showed icterus, congestion and swelling of the lymphatic glands and of the spleen, haemorrhages under the renal capsule, parboiled appearance of the heart and skeletal muscles, and urine rich in albumin.

With regard to the morbid anatomy of chronic cases it was found that in most cases at Buitenzorg the bone could be easily sawn through or even cut; sometimes this applied to all the bones, sometimes only to the humeri and femora, and at other times to the ribs. THEILER attaches no importance to the bony changes as he found them in horses which had died of other diseases or were killed before death as controls. The bones of all the horses suspected of being affected with infectious anaemia by the authors were examined and the changes described above in the case of the third horse examined were found in all.

The authors claim that horses showing the following symptoms should be looked upon with suspicion, viz. (*a*) anaemia with varying colour conditions of one or other of the conjunctivae, (*b*) falling in the stable and difficulty in getting up, (*c*) from time to time a few days fever without apparent cause, (*d*) swellings of the belly, sheath, or hind limbs in the absence of surra, (*e*) diminution or absence of appetite without apparent cause, (*f*) loss of condition in spite of good feeding, (*g*) slipping a great deal in the stable, (*h*) abnormal tiredness, (*i*) stiffness of movement in the form of ataxia, or lameness without apparent cause; the shifting of the lameness from one limb to another is very characteristic; the best means of showing this is by lounging once or twice a day for half-an-hour, (*j*) arhythmia or rapidity of the pulse and heart beat; this is often observed in the stable but increases at exercise, with the appearance of a venous pulse. The inoculation of susceptible horses is the only certain means of diagnosis. One has to resort in practice to other less costly, but unsatisfactory, processes.

The authors discuss the tests devised by ZSCHOKKE and by FINZI. The former, who employed the so-called "sinking" test, collected blood in vessels which were cooled down quickly and then the percentage of corpuscles was calculated from the height of the column of corpuscles. The authors added a solution of sodium citrate to the blood instead of cooling it in order to obtain the same result. The test devised by FINZI, consisting in the demonstration of autolytic substances in the serum of suspected horses, was found to give much better results. This test consists in the addition of 5 c.c. of serum to be tested to 1 c.c. of a 5 per cent. suspension of washed red blood corpuscles from a healthy horse. The appearance of haemolysis is stated to point with certainty to the existence of infectious anaemia. According to FINZI haemolysis can thus be produced on the 12th day after experimental infection and in any case after the 24th. FINZI asserts that the corpuscles sometimes become agglutinated under the influence of the affected serum forming small clumps about the size of pins' heads.

The authors were unable to discover albumin in the urine probably because they had not examined a sufficiently acute case. The regular weighing of the animal body in order to discover any loss in weight is also considered to be of importance. The disease can be differentiated from a sclerostome infestation inasmuch as no fever is observed in the latter disease.

With regard to treatment the authors tried the injection of ox gall inasmuch as the Japanese Commission found that sodium taurocholate had a very toxic effect upon the virus. This, however, produced a marked local lesion. Experiments are being performed in connection with the use of sodium citrate. The serum from recovered horses is, of course, dangerous as it still contains virus.

With regard to preventive treatment the authors recommend slaughter of all affected animals. Infected mares are dangerous and their foals are probably born infected or later imbibe the virus with the milk. Purchased horses should be carefully examined by being placed on light work for a few days coupled with a test of the serum if possible. Australian horses are held under most suspicion as the disease is believed to be imported undoubtedly from Australia. South African, Tonkin, and Japanese horses are also suspicious; Indian and Mongol ponies are recommended. The author in conclusion details a series of preventive measures applicable to this disease.

NEVERMANN (L.), MIESSNER (H.) & WEICHEL (A.). **Studienreise nach dem Balkan.** [Travel Studies in the Balkans.]—111 pp. With 80 text figs. & 2 tables. 1917. Hannover: M. & H. Schaper. [Price Mark 3.50.]

This publication consists of a description of a journey undertaken by the above three authors to Bulgaria and Turkey at the request of the German Minister of Agriculture in October 1916, with the object of studying the contagious diseases of animals of these countries and the methods there employed in dealing with them.

A considerable number of details are included respecting places of general interest in, and the economic aspects of, the countries visited from the point of view of agriculture and stock-breeding. As regards contagious diseases information was obtained on sheep pox in Bulgaria and rinderpest in Turkey. These two diseases are apparently responsible for by far the most serious epizootics among stock in these countries. A few remarks are given on equine piroplasmosis on the Macedonian front of the Bulgarian army.

The following figures represent the live stock returns for the year 1910 in Bulgaria:—horses 478,222, asses 118,488, mules 12,238, cattle 1,606,363, buffaloes 412,978, sheep 8,669,260, goats 1,464,719, and pigs 527,311. Before the year 1880 stock breeding in this country was in a very neglected state but considerable progress has been made since its independence. The control of stock-raising is at present very largely in the hands of Government veterinary surgeons; the two national studs are managed by veterinary surgeons. The cattle are principally of the Podolian breed and are used for food and draught purposes. Sheep-breeding is of the highest importance, mutton representing the chief meat food of the people while sheep-milk and cheese form a large part of the human food. Pig breeding is of minor importance probably largely on account of the fact that pig food is not grown. The poultry industry is very important.

Details are given with regard to the Bulgarian Veterinary Service, an organisation of recent origin, but which proved its efficiency in the eradication of rinderpest after its introduction into the country during the late Balkan war. There is no veterinary school in the country, students being trained abroad, principally in Germany and France. Further details are given with regard to the veterinary bacteriological institute in Sofia, which is under the direction of Dr. ANGELOFF. This consists of a well-equipped laboratory where sera and vaccines for dealing with the more important animal diseases and even some human diseases are manufactured. In connection with this institute there is a rinderpest station, situated at Burgas on the Black Sea coast, which was erected by ANGELOFF for the suppression of rinderpest in Bulgaria during the 1912–1913 Balkan war.

Equine piroplasmosis.

A short visit was paid to the Macedonian front to study equine piroplasmosis. Information was obtained that the disease occurs chiefly during the months June-August. In the summer of 1916 about 200 horses belonging to the Bulgarian-German troops were affected. The native horses of this region are only slightly or not at all affected. The symptoms commence with loss of appetite, dullness and rising temperature, followed by a yellowish discolouration of the eyelids, and petechiae on the mucous membranes of the eyes, mouth, and nostrils. Later, loss of condition and oedema set in. Piroplasms in varying numbers may then be discovered in the corpuscles. Some of the animals die, the others become chronically affected, emaciated, and die from exhaustion. On all animals were found ticks of the species *Dermacentor reticulatus*. At the time of the authors' visit no animals were suffering from the acute stage but several horses were seen which had become affected in the preceding June and had recovered; no piroplasms were discoverable in the blood of these animals. The weather during the preceding summer had been hot, rain falling on only a few days. Horses were picketed in fields; where only a small proportion of animals were slightly affected these fields were rather dry, but acute cases occurred in the wetter fields which were also covered with shrubs. Haemoglobinuria was rarely observed. In the Second Bulgarian Army during the spring and summer of 1916 out of 1,500 horses belonging to five mounted units about 200 became affected with piroplasmosis, from which about 40 died.

Sheep pox in Bulgaria.

This disease is of very great importance on account of the relatively great dependence of the country on its sheep industry. (There are about 26 times more sheep per head of human population in Bulgaria than in Germany). The danger of the importation of the disease into Germany during the present war had also to be taken into consideration owing to the very close relationship existing between that country and the Balkan States. The disease has already appeared around Breslau on account of sheep imported from Macedonia and also in those parts of Russia occupied by German troops. The ten million sheep in Bulgaria are distributed mostly in flocks of from 50 to 100 head owned by the peasants and remain at pasture the whole year. Material for study was easily obtained on account of the widespread distribution of the disease throughout the country. An account is thus given of two affected flocks kept at places lying a short distance from Sofia. In one of these places the sheep had been vaccinated and when examined about a fortnight later all appeared sound with the exception of two or three sheep, which were dull and not grazing. A brief description is given of the symptoms exhibited by these animals and a full description of the disease in a naturally affected animal on the same place. A very full account is also given of two affected animals in a second outbreak. The descriptions are accompanied by a number of photographs of the lesions. The symptoms and lesions correspond with those given by other authors and also in text books. These are, briefly, slight muco-purulent discharge from the nose and eyes, papules and pustules from the size of a lentil up to a bean on the upper and lower lips together with crusts and scars as the result of the bursting and healing of these lesions. Similar eruptions could be discovered on the woolly part of the skin; the submaxillary glands were swollen and painful; the skin on the inner surface of the fore and hind limbs, around the vulva, and under the tail likewise revealed eruptions in various stages occurring simultaneously. The papules were red and painful, and later formed cupola-shaped pustules which burst forming shallow ulcers, and these became covered afterwards with a scabby mass about the size of a shilling. No internal lesions were seen in the very few cases examined post-mortem by the authors, although pneumonia is very often observed and inflammation of the subcutaneous lymphatic glands; widespread and very numerous lesions of the skin are observed in such cases.

On account of the widespread character of sheep pox in Bulgaria vaccination is at present extensively performed although by this means new virus carriers are artificially produced. The number of sheep vaccinated yearly varies from 500.000 to 800,000. The losses caused by this operation reach from between 0·4 to 0·6 per cent. while, on the other hand, the losses caused among affected flocks left unvaccinated vary from 5 to 50 per cent. As soon as an outbreak is reported the whole of the affected flock is vaccinated free of charge, usually together with all flocks in the neighbourhood. The vaccinated sheep are placed under the same regulations as the affected animals and are held to be infective for three months, during which time the animals are strictly isolated.

The lymph is always obtained from artificially infected sheep, and not from natural cases as is more usually done, inasmuch as material free from outside contamination can be prepared in this way. The sheep employed for lymph production is shorn over the right side of the chest and abdomen. The patches to be inoculated are shaved and swabbed with 3 per cent. boric acid solution. The sheep thus prepared is secured on a table with its right side facing upwards and lymph from a previously infected animal is usually applied to twelve different places at a distance of about two fingers breadth apart. The inoculation is performed by means of a specially constructed syringe which can be regulated so as to deliver half or whole drops of fluid. The syringe is fitted with a very fine thin needle about 1 inch long which is inserted with a slight turning movement within the skin along its whole length until its point emerges from the needle tract; the needle is then pulled back to within a short distance of the point of entry and one drop is squeezed into the canal. If a trace of this drop appears at the exit of the needle path then the cutaneous application has been correctly performed. Each skin patch receives four such needle tracks of which two lie above one another so as to form a continuous line while the other two run across this path perpendicularly to its middle.

The seat of injection shows a slight swelling in from 4 to 5 days. The temperature rises on the 3rd to the 4th day after injection to from 40° to 41° C. Later a red raised hot painful papule about the size of a two shilling piece appears. Lymph is usually collected on the ninth or tenth day. The collection of material later is not recommended on account of the necrosis of the overlying skin and subsequent infection.

In order to secure the lymph the sheep is fixed as before and the skin and swelling shaved, washed, and douched with boric acid solution, mopped with cotton wool and dried with a sterile cloth. One presses an area of skin between the thumb and forefinger so as to form a fold containing the papule and clamps the base of this fold by means of two strong pairs of forceps. A horizontal incision is then made along the length of the fold and the fluid exuding from the wound is sucked up into a syringe fitted with a wide bored needle. A further quantity is obtained by deeper incision. Another incision is then made outside the first incision laterally under the skin. By placing two additional pairs of forceps within the first two one can squeeze out the fluid still remaining in the tissues after the incision and then suck it up. In order to obtain the last drop of lymph from the papule a third pair of forceps is placed between the second pair. In this way from 10 to 15 c.c. of lymph can be obtained from a papule, or 100 to 150 c.c. from the twelve papules obtained on one animal.

The lymph is then mixed with from 2 to 6 times its bulk of 3 per cent. boric acid solution, filtered through gauze, and distributed in tubes, each containing 1 c.c., which is sufficient for about 100 animals. The degree of dilution depends on the quality of the eruptions. If the animal presents marked eruptions and a typical rise of temperature together with symptoms of a severe general infection, the lymph obtained is very virulent and is most highly diluted. On the other hand if the papules are feebly developed and the sheep is only affected with slight general symptoms, the lymph is slightly diluted.

The inoculation of flocks is performed by means of the same kind of syringe as is used for the lymph-producing animal but furnished with a very strong short needle with a lancet-shaped point. The needle attached to the syringe is inserted through the skin of the ear, a small ring situated just above the point preventing it from penetrating too deeply. The point is then turned so that the opening of the needle faces the cartilage of the ear and a half or one drop of lymph is then pressed out of the syringe. Adult animals are given 1 drop, lambs only ½ drop. These quantities are stated to be easily given by means of the mechanical arrangement fitted on to the piston of the syringe. On account of the deterioration of the lymph on keeping ANGELOFF uses only fresh or less than 2 to 3 weeks old lymph, and thus only a small stock is kept in reserve.

Rinderpest in Turkey.

The consideration of this disease as it occurrs in Turkey is preceded by a chapter in which the agriculture and veterinary service of the country is described at some length. Agriculture, although constituting almost the sole industry, appears to be in a deplorably backward condition partly owing to former misgovernment and partly owing to the fatalistic temperament of the inhabitants. The animal population at present is composed of 6,132,507 cattle, 864,000 buffaloes, 1,500,000 horses, 144,000 mules, 1,370,000 asses, 20,000,000 sheep, 17,000,000 goats, 320,000 camels, and 40,000 pigs. The improvement of stock by breeding hardly exists. In Anatolia native cattle consist of small wretched looking animals hardly more than 3½ to 4 feet high; draught oxen are composed of the greyish-white Podolian breed. Similarly the horses mostly used consist of the small but very hardy and tough Anatolian horses, which are used for draught and pack purposes and crossed with Arab blood for riding purposes. Sheep and goat breeding is very extensive as in Bulgaria but pig breeding is extremely small owing to the Moslems' religious distaste for pork.

The veterinary service of the country is of very recent origin. In 1858 a military veterinary school was opened at Constantinople under the direction of French teachers. A civil veterinary school was opened in connection with the medical faculty of the University of Constantinople in 1889 and after various changes an independent school was built in 1900. Eleven years later this institution was burnt down but owing to internal disturbances it has not yet been reconstructed. In 1910 owing to the great need for veterinary surgeons a two years course was instituted for so-called army surgeons who are appointed to assist the fully trained veterinary surgeons. Veterinary teaching in the civil school is in abeyance during the present war. The military school at Scutari is a modest building in which students undergo a four years course which, until recently, was conducted in the French language.

There are three research and serum Institutes in Asia Minor, viz., at Pendik, established in 1910, Eskeschir, established in 1913, and in Aleppo (removed from Ersingian), established in 1911. The work of these Institutes consists mainly in the manufacture of rinderpest serum. Details are given regarding the organisation of the civil and the military veterinary services.

Rinderpest is always enzootic in Turkey in Asia and has always found easy means of transportation into Turkey in Europe. Owing to the very strict police measures adopted in Bulgaria the disease has been prevented from spreading towards the remainder of Europe. For a long period during the late Balkan war, however, the eastern portion of Bulgaria became affected owing to the importation of the disease with the stock of fugitives. Considerable apprehension is expressed lest the disease should gain access to the territories of the Central Powers owing to the importation of cattle used for slaughter and transport by Turkish troops fighting in those countries. The danger is increased owing to the lack of knowledge of the veterinary surgeons of those countries regarding the primary symptoms exhibited in the scene of an outbreak.

Next follows a description of the pathological institute at Pendik situated in Asia Minor on the borders of the Sea of Marmora. This consists of well-equipped laboratories and buildings erected in 1910 at a cost of about £10,000. Accommodation is provided for about 300 serum animals.

For virus production the above-mentioned small Anatolian cattle are used. These are infected subcutaneously with from 5 to 10 c.c. of fresh defibrinated blood from a sick animal; in from three to five days a rise of temperature to 40° or 41° C. takes place and during the following two to four days distinct clinical symptoms affecting in some cases the respiratory and in others the digestive tract appear, and also symptoms affecting the conjunctiva and the buccal mucous membrane; the appetite completely disappears. Very soon the temperature drops suddenly and death occurs within the next 24 to 48 hours. In order to render suitable virus the animals should show distinct clinical symptoms besides fever and inappetence, and such a virus is obtainable as soon as diphtheritic lesions on the mucous membranes or marked diarrhoea appear. The virus animals are bled from the carotid artery into a flask containing a certain quantity of alkaline sodium citrate. The jugular vein is in the meantime connected with an apparatus for the infusion of sterile salt solution in order to obtain as much virulent blood from the artery as possible. In this way from 6 to 8 litres of blood mixed with salt solution can be obtained from a small Anatolian ox. The virus remains in the blood from 10 to 15 days, but the blood is as a rule injected immediately into the serum animals.

In order to obtain sufficiently large quantities of serum only cattle of the large Podolian breed are used for serum production. A so-called ground immunity is produced by the subcutaneous injection of 1 c.c. of virulent blood on one side of the body and 50 to 80 c.c. of anti-rinderpest serum on the other side. The inoculated animals are observed during the following days and should serious symptoms arise a further application of serum is made in order to avoid a fatal termination. If, however, the animal only reacts slightly then a further subcutaneous injection of 20 c.c. of virus is made on the 20th day and if no appreciable reaction follows a dose of from 1 to 3 litres of virus is at once injected intra-peritoneally. If on the other hand the animal reacts strongly to the first injection then a dose of from 1 to 3 litres is injected intraperitoneally on the 20th day. The serum animals are bled in the standing position and four litres of blood are withdrawn at each blood-letting. Five days later a further four litres of blood is taken, and again after another five days a similar quantity. The animals are allowed to recuperate for ten days, and then receive a fresh large dose of virus intra-peritoneally; bleeding is repeated as before, commencing after an interval of 12 days.

On account of the frequent occurrence of piroplasmosis one has to be careful to employ animals whose blood is free from piroplasms for virus production. The blood of these animals is thus examined during the whole period they are under experiment and as soon as piroplasms are detected they are treated with trypanblau. If the piroplasms disappear from the blood up to the climax of the rinderpest infection then the blood is used for the injection of the serum animals; on the other hand, if the parasites remain in the blood the animal is discarded from further use. One has thus to reckon with 30 per cent. piroplasm infection among the virus animals, whilst a further 20 per cent. of the virus animals are of no use inasmuch as they contract too mild a disease for the production of suitable virulent blood. The institute delivers about 600 litres of serum per month, uses up about 700 virus animals in the course of a year and keeps up a stock of about 150 serum animals.

The method employed in Bulgaria for the production of anti-rinderpest serum was as follows :- -

While no serum was available a ground immunity was set up by the inoculation of 10 to 15 c.c. of gall subcutaneously followed 10 to 15 days later by a subcutaneous injection of from 1 to 5 c.c. of virus. Later on this immunity was set up by the injection of 10 c.c. of serum on the left and 1 c.c. of virus on the right side of the neck. The further procedure differed according as to whether the rapid or the slow method of obtaining serum was employed.

(*a*) Rapid method.—(1) As soon as the animals recovered, 1 to 3 litres of virus subcutaneously, after two weeks, (2) 1 to 7 litres of virus subcutaneously, after 12 days a first bleeding of 4 litres, after a further five days a second bleeding of 4 litres, after a further five days a third bleeding of 4 litres, after three weeks (3) 1 to 7 litres of virus subcutaneously, and later after 12 days bleeding as before.

(*b*) Slow method.—(1) Half litre virus subcutaneously, after 10-14 days, (2) 2 litres of virus subcutaneously, after 10-14 days (3) 2 litres of virus subcutaneously, and so on until 6 litres had been given.

More recently the rapid method was used for the most part. After the production of a ground immunity by the injection of 10 c.c. of serum and 1 c.c. of virus and recovery of the animal 2 to 8 litres of virus were injected subcutaneously. After 10 days the animals were bled for serum.

The authors next devote a considerable amount of space to the symptomatology and morbid anatomy of the cases observed by them during their visit. This description is accompanied by a number of quite good figures. Nothing new, however, is added to what is already known regarding these matters.

In Asia Minor rinderpest is frequently complicated with piroplasmosis. Animals thus affected pass a red-coloured urine and on post-mortem reveal marked swelling of the spleen. Piroplasms are easily discoverable on blood examination. These animals undoubtedly had been subject to a previous attack of piroplasmosis, the parasites as is well known being capable of remaining in the body for years without setting up apparent symptoms.

Outbreaks of rinderpest in Turkey are dealt with in the following way :—As soon as the disease is reported in a locality all animals showing a rise of temperature are isolated. All animals showing clinical symptoms such as lachrymation, lesions on the buccal mucous membrane, and diarrhoea are immediately slaughtered. The cattle showing no fever and which are otherwise apparently healthy are quarantined and injected with anti-rinderpest serum (ox 80, buffalo 100° c.c. subcutaneously). From the 2nd to the 9th day the temperature is taken daily and if a temperature of over 40 C. is registered on two occasions the animal is slaughtered. On the 15th day the serum injection is repeated. No further temperature readings are made. A month after the appearance of the last case of rinderpest the quarantine restrictions are raised.

Brogan (G. H.). **Notes on Contagious Bovine Pleuro-Pneumonia in Northern Rhodesia.**—*Vet. Jl.* 1917. Oct. Vol. 73. No. 10. pp. 369–371.

This disease was introduced into Barotseland in 1915 from Portuguese West Africa where it appears to have been enzootic for several years. From there it was brought down to several cattle districts on the railway line by traders and a number of deaths from the disease seems to have occurred during transport.

The disease then spread rapidly among cattle in the areas into which it had been introduced, probably owing to the absence of a qualified veterinary staff. Energetic measures were, however, carried out as soon as possible involving quarantine of all herds in each suspected area, slaughter of all affected animals, inoculation of all in-contacts and suspected in-contacts as far as the supply of virus permitted, branding of all animals so inoculated, and finally the establishing of a " buffer " area in which no cattle movements of any kind were allowed for some time in order to cut the disease off from the remaining cattle districts. The slaughtering of affected animals met with considerable opposition owing to the attitude of the cattle owners who maintained that some animals recovered and became immune.

Pleuro-pneumonia inoculation, although nothing like so satisfactory as the simultaneous method in rinderpest, is considered to be in the writer's experience a beneficial measure in infected areas in those countries where wholesale slaughter is out of the question. The inoculation sometimes has to be performed repeatedly in order to obtain a satisfactory reaction. Glycerinated virus was used. The so-called " thread " method was found to be more convenient in practice than inoculation by means of a syringe. When the inoculation was carried out by the owners themselves gangrene often occurred owing to secondary infection and heavy mortality resulted.

The disease first appeared in the Kalomo district in May 1915, and the heaviest losses took place before the end of July. Measures to eradicate the disease were then undertaken with the result that the last case occurred on November 11th 1916, and no further cases were reported during the following seven months; the possibility of the existence of a few so-called " lungers " is, however, borne in mind.

A few statistics are given,—deaths from pleuro-pneumonia, total 561, deaths after inoculation 644; 9,709 remained alive, apparently after inoculation.

MISCELLANEOUS.

(a) Bovine Haematuria.

Hadwen (Seymour). **Bovine Hematuria.**—*Jl. Amer. Vet. Med. Assoc.* 1917. Sept. Vol. 51. (New Series Vol. 4). No. 6. pp. 822–830.

The condition described by Hadwen is defined as a disease of cattle which appears most frequently at the end of winter and is characterised by the emission of blood of vesical origin in the urine. In 1914 (Report of the Veterinary Director-General of Canada) the author advanced the so-called oxalic acid theory to account for the origin of the disease and a further series of experiments are detailed in this paper in support of his contention.

In the primary stages of the disease the animals show no apparent symptoms except that they urinate more frequently than normally and pass blood at the end of the act of micturition. In the later stages of the disease the animals develop a depraved appetite, become emaciated and anaemic owing to repeated loss of blood and later affected with diarrhoea, and finally die of cachexia. It is difficult to state the average duration of the disease owing to the fact that the earlier symptoms may be overlooked, but as a rule animals do not die within a year after they have first manifested symptoms while in some cases they may live on for years in apparent good health except for the emission of bloody urine. In the late stages of the disease complications may arise especially due to the invasion of the bladder and kidneys by pyogenic cocci. The average age at which animals become affected is 6 years. The disease is associated with poor farm lands such as woodland, newly cleared farms or farms that are either neglected or falling out of cultivation.

The mucous membranes of the urinary tract vary markedly in different cases. Sometimes they are in the form of rough raised red ridges, in others they appear normal except for eroded bleeding patches and sub-mucous haemorrhages. In long-standing chronic cases there is fibrous thickening, a tendency to proliferation and the formation of papillomatous outgrowths. The walls of the bladder may thus lose all power of dilating and in such cases there is an almost constant dribbling of urine containing, as a rule, but little blood. In other chronic cases the bladder becomes permanently dilated owing to the occlusion of the urethra with blood clots. Cicatrices are rarely encountered, showing that as a rule there is no tendency for the lesions to heal. The lesions appear most active towards the end of the housing period, viz., the month of February. The other organs of the body generally appear healthy.

The amount of blood passed with the urine in two cases during 24 hours was found to be 1,101 and 738 c.c. respectively, but it was found that these amounts might diminish considerably from time to time. Clots in the urine are common in the late stages when blood is present in larger quantities; in the early stages the salts in the urine are present in sufficient quantity to prevent coagulation. On sedimentation, as a rule, the red corpuscles have a normal appearance. Haemoglobinuria is sometimes seen in the advanced stages; the urine is generally strongly alkaline in reaction. At first the urine is nearly always sterile but after a time the bladder becomes contaminated especially with streptococci which have also often been found in the kidneys. The calcium oxalate crystals which are believed to play a very important part in the production of the lesions are more abundant in the early stages of the disease.

ROGER, however, notes that the number of crystals is not always a true indication of the amount of oxalate in the urine.

In the early stages the circulating blood appears normal but later the red corpuscles present the usual changes seen in secondary anaemia.

In 1914 the author recorded experiments which showed that oxalic acid was very toxic on drenching but that later on the animals became accustomed to it. It was found that 30 grammes could be safely given daily if the animals were allowed an occasional rest. One cow was thus given 395 such doses but remained in excellent condition and on slaughter the bladder was found to be rough and thick while no other lesions were found in the body. Another cow was given 577 daily doses (May 1914–March 1917) and remained fit and well for up to 2 years and 3 months. Later despite care and extra food the animal gradually declined in condition and commenced passing red urine until she became so weak as to be unable to get up and was slaughtered (March 1917). On post-mortem examination the carcase was thin and dropsical but all the organs appeared normal except one kidney, which was slightly cystic, and the bladder; the mucous membrane of the latter showed petechiae and vegetations and a large quantity of oxalates were found in the red urine.

A steer was given a series of 697 doses (November 1913–March 1917) commencing with small doses at the age of 2 months. The animal remained in very good condition but its growth was distinctly stunted and no symptoms of disease became apparent after this treatment except that albumin and abnormal quantities of crystals were passed in the urine. The author remarks that the feeding of oxalic acid bearing plants would be the best way of reproducing the disease but owing to the difficulty of getting these in sufficient quantity commercial oxalic acid was used.

In 1914 the author claimed to have shown that passage of blood in the urine as in natural cases could be set up experimentally by the irritation provoked by the repeated daily injection of calcium oxalate crystals into the bladder. Three experiments are recorded in which it was shown that injections of dilute oxalic acid solutions into the bladder provoked great irritation and that subsequently the urine was stained with blood. Calcium oxalate crystals were found in the bladder as soon as the acid came into contact with the urine and mucus. After a time the urine became contaminated with bacteria which no doubt played a part in aggravating and maintaining the lesions. Two out of the three cases developed a disease indistinguishable from natural cases of haematuria.

According to the author the only objection MOUSSU raises to his theory is that if haematuria were set up only in consequence of animals eating irritant plants then in the majority of cases they should recover when removed to healthy regions; but MOUSSU admits, however, that it is probable that the lesions once firmly established cannot be cured. As the result of close observation of 66 cases in British Columbia the author himself found that not a single case lived over five years after showing the initial symptoms. Remissions occurred during which periods the animals might appear to be in perfect health but they always broke down again and never lasted for much more than a year. In British Columbia the disease is confined almost entirely to the bench lands bordering on the Pacific. CLELAND noted the same thing in Australia and CASE in Hawaii. The author thus does not hold forth any hope for treating the disease successfully, but recommends prophylactic measures consisting in the agricultural improvement of the pastures grazed over by affected animals.

(b) "RENGUERA."

TABUSSO (M. E.). **Paraplegia enzootica negli agnelli.** [Enzootic Paraplegia in Lambs.]—*Clinica Vet.* 1917. Aug. 31. Vol 40. No. 16. pp. 457–472. With 1 text-fig.

This preliminary communication issued by the Director of the National Institute of Agricultural Microbiology, Lima, deals with a disease affecting almost exclusively lambs in the Andes regions of Peru and known locally under the name of *renguera* (lumbago). Clinically the disease is characterised by disorders of the locomotory system starting as a paresis and ending up with general paralysis. The disease appears to be of a contagious character inasmuch as in infected flocks from 98 to 100 per cent. of the newly born lambs may become infected. The course of the disease lasts on an average from 1 to 2 months although in some cases, especially in very young lambs, it may not extend beyond a fortnight; the disease always terminates fatally, death being brought about not so much by the disease itself as by inanition due to the lambs' inability to feed.

The Peruvian *renguera* was first studied by L. Maccagno in the infected regions and his observations corresponded exactly with those of the author. There are very few accounts in veterinary literature of diseases corresponding with this affection. An Argentine observer, J. M. Quevedo, has described a group of affections known as *la pataleta* and characterised essentially by cerebro-spinal disturbances, affecting stock in the southern regions of the Argentine and taking the form of localised outbreaks. Enzootic paraplegia of sheep was first studied in 1908 by Baby, who recognised it as a new disease affecting exclusively ovines and showing symptoms comparable to those produced by the administration of repeated doses of a convulsant poison; he further noted that the affected animals grazed over low and marshy pastures and got better when transported to high and dry localities. Lignières (1900) denies its contagious nature as no specific micro-organism was discoverable. Sivora (1911) attributed the disease to the toxic effects of the Preisz-Nocard bacillus.

The Argentine *pataleta* (or *tembladera*, *vértigo*, *chucho*) first manifested itself in Patagonia in 1907 and attacked horses, cattle, and young lambs, the symptoms in these various species of animals being similar in each case, but sheep were most often attacked. On being urged to run the animals began to tremble in the hind legs as if suffering from paraplegia and before long fell to the ground as if their tendo Achilles had been cut, thus assuming a dog-sitting position; death was due to inanition and the disease was seen especially towards the end of the summer and during the autumn. No lesions were discovered in connection with the nervous system or other tissues and causal organisms could not be demonstrated. Quevedo believed that the disease might be due to the ingestion of various Graminaceae and Leguminosae such as *coiron* grass, which is only eaten during periods of great drought. Reference is made to other authors who have studied the disease in other parts of the Argentine. Some of these ascribed the disease to a fungus found on a certain species of grasses. Reference is also made to a paralysis of sheep occurring in South Africa which is believed to be tick transmitted. The author mentions the fact that S. H. Gaiger had been set to work on the disease in infected centres at the time of his writing [see following extract].

In Peru the disease is at present confined to a few provinces in the Department of Junin, forming a tableland situated at an elevation of from 4,000 to 4,500 metres above sea level in the Cordigliera of the Andes and just below the ice line. The climate is cold, varying from – 5° C. to +15° C. and has only two clearly defined seasons, viz., one termed winter with a relatively high temperature but with heavy rains and daily storms (October–March) and the very cold summer with hard nocturnal frosts (April–September). The whole zone consists of natural pasturage with a predominance of Graminaceae and is rich in water which comes from the snowclad regions above. The subsoil is very rich in minerals. The pasture is grazed over exclusively by sheep and a few llamas. Each ranch contains on an average from 20,000 to 40,000 sheep distributed over vast stretches of land in groups of several hundred animals living entirely in the open air. In the case of a fresh outbreak in a flock there is always a history of its having been contracted from a neighbouring infected flock; the infected region becomes more extensive every year and at present covers a surface of several thousand square kilometres. The author then gives statistics dealing with the extremely high mortality and serious economic losses caused by the disease in large flocks.

The disease appears to have first appeared in Peru about 1911 as no history of a similar disease can be traced to have existed before that time. The disease cannot be of a digestive or mineral origin as the pastures have remained in the same condition in these districts for centuries. There appears to be good reason to believe that the disease was most probably imported from the Argentine, inasmuch as shortly before it was first reported a few sheep were introduced for the first time for cross-breeding purposes from Patagonia and other neighbouring provinces into the ranches in which the original outbreaks occurred. As stated above, a disease which is probably exactly similar has been studied in the Argentine since 1908. In 1910 there was a large importation of Argentine cattle, horses, sheep, etc., into Peru and these introduced into the country, among other diseases, foot-and-mouth disease.

Animals attacked.—According to shepherds cases of *renguera* are said to have been observed amongst the llamas and sheep dogs in the affected regions but the author doubts the accuracy of these statements. The regions affected communicate with a rich cattle breeding region known as the *sierra* lower down at a height of 3,000 to 3,500 metres and in one ranch situated on the border line a fatal disease corresponding with that seen in lambs was observed affecting three calves. The disease affects sheep of every breed and condition to the same extent but shows a marked predilection as regards age; lambs up to 6 to 8 months old are most susceptible, especially when they are from 2 to 4 months old, but yearlings are also attacked to a less extent. Adults very rarely become affected.

The disease is most prevalent during the rainy season (the local winter), that is, during the period in which lambing mostly takes place. The number of affected animals increases considerably after cold and damp nights.

The following were the more important symptoms observed by the author in the course of a study of naturally occurring outbreaks and a few cases in the laboratory. In typical cases the disease assumes a sub-acute character with an average duration of from 1 to 2 months. In some outbreaks, however, the acute form predominates affecting more than 90 per cent. of susceptible animals, producing a mortality of about 100 per cent., and completing its course within a month. Rarely, cases of a chronic character are seen, terminating fatally after a long period, while in some instances such as with cases transported into a suitable climate and properly nourished, gradual improvement in the symptoms may be seen.

The disease appears to manifest itself suddenly without preliminary symptoms and affects primarily the hind limbs. No cases in which the fore limbs were first affected have been seen. Neither at the beginning nor during the later course of the disease does the affected animal show noteworthy general symptoms. The disease thus begins with lack of co-ordination of the hind quarters, and dragging of the hoofs with consequent lesions on the coronets. The animal remains at the end of the flock and assumes a characteristic posture with the legs apart. Later paresis sets in and when the animal is urged to move the affected legs give way and it falls on its hind quarters or on its side; with some effort the animal soon resumes its standing position, but again falls as before when it attempts to move and after a number of falls rests stretched out on the ground with its hind quarters completely immobile. Next the animal falls so frequently that paraplegia sets in definitively and then death from inanition invariably ensues owing to the inability of the lamb to graze or follow its mother. In acute cases the inco-ordination, paresis, and paralysis are manifested in the fore limbs also and in such acutely affected cases giddiness and trembling are often observed either generalised all over the body or confined to the head. No specific lesions are seen on post-mortem examination. The carcase shows signs of inanition and the muscles of the affected quarters are atrophied. Naked-eye examination of the nervous system showed nothing abnormal except slight congestion of the meninges; in very severe cases congestion of the spinal cord especially the lumbar portion can be observed. The lumbar plexus shows no lesion.

The experimental studies made by the author gave no indication as to the etiology of the disease. Examination for causal organisms either directly or by attempted artificial transmission of the disease always gave negative results. Microscopic examination of the blood in a great number of cases revealed no micro-organisms except a few diplococci in two or three cases. Moreover, it is highly improbable that a protozoan blood parasite can be connected with the disease, inasmuch as it only attacks lambs in a cold region where the ecto-parasites which usually transmit organisms of that kind are completely absent. *Melophagus ovis* is the only widely diffused species. Examination of the cerebro-spinal fluid gave similar results while the smears from the other organs and tissues gave constantly negative results.

A few cases were kept under observation at the laboratory with a view to making cultural examinations. Blood cultures from 15 cases examined after natural death remained sterile or developed growths of the common putrefactive organisms. In three cases the cultures from the cerebro-spinal fluid and from the blood revealed a Gram-positive diplococcus. A large number of haemo-cultures were made from 14 cases studied over a period of two months during the course of the disease. Blood from the jugular vein was thus incubated under aerobic and anaerobic conditions. Ten per cent. of these became accidentally contaminated; 50 per cent. were sterile, the rest, that is to say, 40 per cent. revealed a coccus generally in the form of diplococci and Gram-positive. This organism grows readily, even under anaerobic conditions, on the ordinary culture media and rapidly produces a uniform thin silky-looking film with no special odour. The author does not believe that this organism is responsible for the onset of the disease inasmuch as (1) inoculation into common laboratory animals and healthy lambs failed to reveal any pathogenicity, (2) control experiments showed that an organism identical in appearance could be isolated from healthy lambs living in regions not affected with *renguera*, and these lambs, in which the organism was discoverable, remained healthy for a long period afterwards at the laboratory.

In six cases of the disease examined immediately after death the blood of four gave cultures of the diplococcus and two remained sterile, while similar results were obtained on sowing out the cerebro-spinal fluid. Inoculation of media with the pulp of the enlarged lymphatic glands always gave negative results.

According to the author repeated attempts at transmitting the disease artificially in various ways gave constantly negative results. The author then briefly summarises some of his experiments dealing with the attempted transmission of the disease by cohabitation and inoculation of material suspected to be virulent. In the cohabitation experiments in addition to healthy lambs pregnant ewes were placed with the affected animals in order to determine whether the infection takes place during foetal life. In two experiments transmission by means of ecto-parasites was attempted by placing sheep keds, gathered from affected lambs, on healthy lambs.

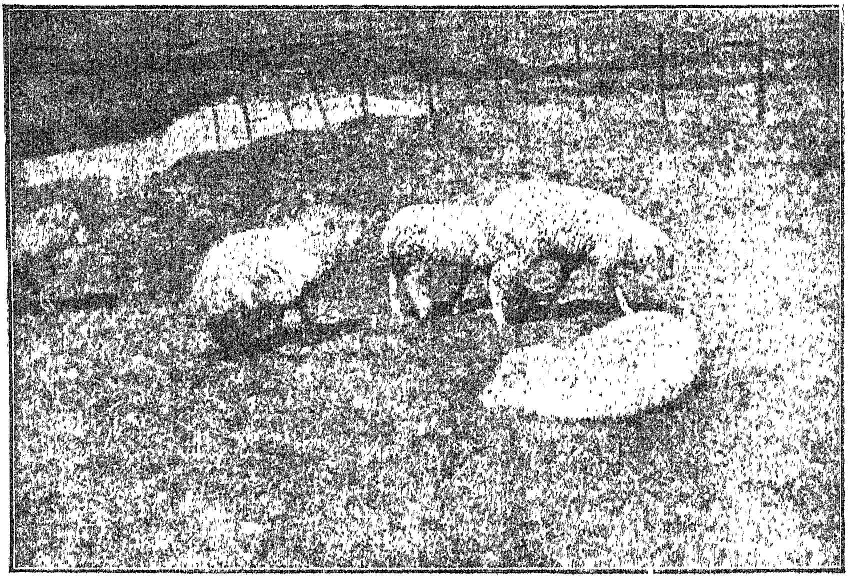
In his conclusions the author states that this paraplegia of lambs reminds one very strongly of infantile paralysis in its endemic form and suggests the probability of its being caused by an ultravisible virus. The only prophylactic measures at present possible are isolation of infected flocks, immediate slaughter of all affected animals, and a change of pasture from low marshy districts to higher, dry regions.

GAIGER (S. H.). **Renguera: A Paralytic Sheep Disease in Peru.**—*Jl. Comp. Path. & Therap.* 1917. Sept. Vol. 30. Pt. 3. pp. 185–209. With 4 text figs.

This paper contains an account of the work done by Gaiger during a visit to Peru in the latter half of 1916 with the object of investigating the disease already discussed in the preceding extract. The work was conducted on behalf of a number of sheep farmers who were suffering very considerable economic losses owing to the large mortality amongst their lambs each year. The laboratory material necessary was taken out from England. Gaiger first gives a good description of the peculiar local geographic and climatic conditions prevailing in Peru together with the sheep-farming customs. The native sheep, which are of a very poor type, are now being improved by crossing, mostly with the Romney Marsh breed. The small laboratory was fitted up on a large sheep farm– Atocsaico Farm, owned by a British company. This farm was situated at an altitude of 14,000 feet and lay on rolling grass country, the Home Farm being situated in a valley on the banks of a small stream.

A brief description is given of the history of the disease. The word *renguera* is said to be probably derived from the Spanish word *rengna* meaning "injured in the back," and Gaiger remarks that there is a complete absence of any reliable information about the origin and spread of the disease, and does not discuss the probable source of its introduction. Owing to the confusion in the classification of sheep diseases the word *renguera* has come to be used in the case of nearly every sick lamb and the losses attributed to it are said to have been grossly exaggerated, although at the same time the disease itself undoubtedly causes very considerable losses.

The disease had been known at Atocsaico for six years. At first the cases were few in number but they became doubled each successive year until in 1915 they amounted to about 700 out of 5,000 lambs born. On neighbouring farms the losses were very much greater and also increasing every year in importance, one farmer stating that he had lost every lamb in 1915 from the disease. The disease was probably first noticed in Peru about 15 years ago. It is stated to occur only in sheep but it was also reported to affect young llamas; cattle and horses are not susceptible. Symptoms commence in lambs from the age of about 14 days and fresh cases keep on occurring up to the age of 5 to 6 months. The description of the symptoms is similar to that given by TABUSSO. A not uncommon symptom in bad cases in lambs is slight up and down trembling of the head and more rarely this symptom extends to the whole body, which shivers as though from cold; a peculiar symptom in these cases is a frequent grinding of the teeth, making a noise which can be heard 10 or 20 yards away. Clinically, renguera is a disease of the nervous system and resembles an intoxication by some poison working on that system.



* Fig. 3.

These hoggets were being driven to the right when photographed. In falling they nearly always swing half round and fall facing the opposite direction to that in which they were walking. One is seen with its hind quarters collapsing.

In 1915 the author believes that a mortality of 8 or 9 per cent. on Atocsaico Farm was caused by the disease, but, owing to the inclusion of a number of other diseases under the same name the losses were estimated by the farmers to be much higher. Gaiger, also, notes that it is doubtful whether *renguera* of itself would account for many deaths; the cause of death in most cases is inanition produced by the inability to obtain nourishment on account of the paralytic symptoms. In 1916 the mortality was high owing to the prolonged dry season and the lambs were born long before the grass began to grow. It is denied that the mortality is increased by cold and damp for, in 1916, it was exceptionally dry and *renguera* commenced sooner and in younger lambs than ever before.

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* [Reproduced by permission from the *Journal of Comparative Pathology and Therapeutics.*]

Owing to the very rapid onset of putrefaction after death it was decided to attach no importance to post-mortem examinations of animals which had died a natural death; even in apparently healthy lambs Gaiger showed that there may be an invasion, especially with the *Bacillus coli*, from the bowels. The lesions discoverable in the more severe cases in young lambs are said to be as follows: (1) increase in the peritoneal, pericardial, and pleural fluids, these being frequently slightly tinged with haemoglobin; (2) a darker colour of the liver in most cases; (3) slight, but never marked, increase in the colouring of the meninges of the brain and spinal cord; (4) occasional catarrhal condition of the small intestine in lambs; and (5) a not infrequent patchy endocarditis.

The disease is compared with other important non-inoculable sheep diseases whose etiology is unknown, viz., louping-ill, scrapie or lumbar prurigo, and swingback in the British Isles, and *putaleta* in Patagonia. Neither scrapie nor louping-ill exist in Peru but both *renguera* and louping-ill probably exist in Patagonia and are confused together under the name of *putaleta*. The clinical symptoms of *renguera* in its most chronic form are indistinguishable from those of swingback in England, and it may be more than a coincidence that *renguera* has appeared in a part of the world where considerable numbers of Romney Marsh sheep have been imported. It is possible to produce symptoms similar to those of *renguera* by injuring the spinal cord with a fine syringe needle at the seat of lumbar puncture but these symptoms only last for a short while. The absence of ticks removed one factor which would have had to be studied as a possible cause, knowing what one does of the action of *Ixodes pilosus* in Cape Colony and *Dermacentor venustus* in British Columbia in producing paralysis in sheep.

No organisms were discoverable in smears from the blood or any of the other tissues or fluids of the body by direct microscopic examination.

The following were the gross parasites found commonly affecting sheep and lambs:—

(1) *Fasciola hepatica*, very common in the liver of practically every sheep examined. They were to be found in lambs from about two months old.

(2) *Dictyocaulus filaria.* Was very common but never in very great numbers. It was also common in the hoggets and found in lambs over two months old.

(3) *Trichocephalus affinis.* Is perhaps the commonest parasite with which sheep are affected, and is present in greater numbers than any other worm. Found in lambs from about 3 weeks old.

(4) *Oesophagostomum radiatum.* Was frequently found but usually in very small numbers.

(5) *Monieza expansa.* Was sometimes present in adult sheep.

(6) *Cysticercus tenuicollis.* Was very frequently present in the mesentery of hoggets and adults.

(7) *Haemonchus contortus.* Was sometimes seen but rarely present in numbers over six or eight in one animal.

None of the above parasites could be blamed for producing such symptoms as those of *renguera* ; they were to be found equally numerous in *renguera* animals and apparently healthy animals. Also, neither chemical poisons nor poisonous plants could be blamed and no protozoan infection was discoverable.

The author then gives details of a number of experiments carried out with a view to attempting to transmit the disease artificially. Inoculation experiments with brain, blood, cerebro-spinal fluid, peritoneal fluid, and pericardial fluid all failed to set up any symptoms and feeding experiments likewise remained negative. "Inoculation and feeding experiments having failed to transmit the disease it seemed unnecessary in the absence of ticks to resort to cohabitation experiments to see if the disease could be transmitted in this way."

Gaiger then details a large number of cultural experiments which demonstrated the almost constant association of a micrococcus with the disease. These were performed with great care and under difficulties owing to the low boiling point of water at the high altitude of the sheep farm. The technique adopted in obtaining cerebro-spinal fluid is described. Amongst the cases in the *sierra* the coccus was thus found by cultural experiments to be present in the peritoneal fluid in 30 out of 43, pleural fluid in 4 out of 14, pericardial fluid in 5 out of 14, liver in 11 out of 30, gall bladder in 1 case out of 1, blood in 5 out of 25, central nervous system in 10 out of 38, and brain in 1 out of 5 cases in which it was examined. The coccus is stated to have also been found in cases subsequently examined by TABUSSO in his laboratory at the Agricultural College in Lima. Inoculation experiments with this coccus were made into ten lambs and two rabbits intraperitoneally, intra-spinally, by injection into the nasal cavities, or by feeding, with negative results.

An attempt was made to find the coccus in young healthy lambs on Atocsaico. Five were examined and the coccus was found in two in the peritoneal fluid and in one of these two it was also present in the blood. In the other three healthy lambs the coccus did not grow from any of the fluids or tissues of the body but in one case *Bacillus coli* grew from the peritoneal fluid.

Large doses of culture of the coccus failed to set up the disease and so the author made an attempt to find out whether the symptoms might not be caused by the manufacture of a toxin. Peritoneal fluid from a renguera case was pipetted off into a culture tube and incubated for seven days ; 1 c.c. of this fluid inoculated intra-spinally into a lamb produced no apparent ill-effect.

The role of this coccus in the evolution of the disease cannot be determined until one is able to transmit the disease experimentally from infected to healthy animals. The serum of infected animals showed no agglutinative properties for an emulsion of the coccus. With regard to the cultural characters of this coccus the author found that it was sometimes difficult to obtain a first growth from the body fluids. A visible growth was often only obtained after incubation at body temperature for several days. Egg medium was sometimes successful in obtaining a primary growth when other media failed. Sub-cultures grew readily on all ordinary media. There was no growth on gelatin at 20° C.; in broth the organism produced a turbidity which then settled as a distinct deposit to the bottom of the tube. On agar the growth was a clear shining semi-transparent film without colour. On solid media the first growths from the body were sometimes isolated colonies of which there might be five or six scattered over the surface, but more frequently the growth originated in the water of condensation in the bottom of the tube. The coccus prefers a medium slightly alkaline and will not grow on an acid medium. It is preferably an aerobe but grows fairly well under anaerobic conditions. It produces acid and does not ferment glucose or lactose.

The paper concludes with a discussion of the measures that can be adopted to eradicate the disease. Curative measures hold out little promise of success. In judging the efficiency of preventive measures care must be taken to avoid falling into error as very little has ever been done on the sheep farm in the way of keeping proper statistics. The author's view is that the rise and fall of the disease is solely due to the age of the lambs and that the wet or dry seasons do not exert any distinctive influence except as regards their exceptional severity. Experiments in altering the breeding season are about to be made on Atocsaico to see whether the losses from frosts and starvation will be reduced by having the lambs born in April instead of September and it will be instructive to learn whether *renguera* occurs when the April lambs are a week old or not. Also, experiments are to be made to show the effect of breeding from some of the least affected or "recovered" hoggets and the number of cases which occur among the resulting lambs. Further experiments are to be made to determine the preventive value of inoculation of a serum immune against the coccus into young lambs. All lambs are to be destroyed and buried as soon as they become infected. On one farm it was believed that feeding with a mixture of salt and sulphur produced beneficial results.

(c) EQUINE PNEUMONIA.

WATKINS-PITCHFORD (H.). **An Enquiry into the Horse Disease known as Septic or Contagious Pneumonia.**—*Vet. Jl.* 1917. Oct. Vol. 73. No. 10. pp. 345–362. With 6 text figs.

Although the disease above referred to is by no means what is commonly regarded as a tropical disease, it is felt that the subject is of such world-wide veterinary importance and has in the past presented one of the most difficult tasks confronting the investigator into the nature of animal diseases that a brief extract and review of this attempt to solve the problem would not be out of place in this *Bulletin.*

The work undertaken by Watkins-Pitchford was apparently performed by direction of the administrative authorities of the British Army Veterinary Service and the clinical material necessary for the study was afforded by the Swaythling Remount Depot and Veterinary Hospital. The investigation covered a period of eight months, a considerable part of the time being taken up with other duties. It seems unfortunate that research work on a disease which has caused very considerable economic losses among British Army horses should be allotted so small an amount of trained personnel and time.

At the commencement of the report the writer apologises for attempting to construct a "theory upon hazardously meagre data," but then lays down a series of elaborate hypotheses and conclusions in fifty-two numbered paragraphs, at the end of which (para. 52) he "again regrets the hasty and immature nature of the work."

No reference is made to the work of former investigators on the subject and in reality although the author confesses (para. 45) that "he has no adequate works of reference at hand" the style of writing and nature of the argument put forth would strike even the most casual reader with the fact that the large amount of work already done on this difficult question has either been insufficiently consulted or not read at all.

In a brief report furnished in September 1915 the author stated "that no evidence was then forthcoming as to the directly infectious nature of the disease from horse to horse, and the report further aimed at demonstrating the existence of a lengthy and indefinite period of incubation or latency existing between infection and obvious lung involvement."

The same opinion is held in the present report, as can be seen from the following two paragraphs :—

7. "The name of 'Specific' or 'Contagious' Pneumonia, both of which terms are frequently applied to the disease, appear to the writer as misnomers, and there also seems evidence leading to the conclusion that the term 'Septic' is equally inapt as a description of the disease if used in a specific sense.

8. "Recent observations, indeed, suggest the classification of the disease as one of an idiopathic rather than a specific nature, or, perhaps, a standing midway between the two categories, being due to the agency of an organism occasionally present in, but non-pathogenic to, the normal horse, and assuming a pathogenic phase under conditions of lowered vitality in the host which harbours it."

Again in para. 29 a brief summary is given of the theories advanced in the foregoing paragraphs :-

"(a) The great majority of cases of 'specific' pneumonia are preceded by an involvement of the nasal membrane constituting the condition known as 'catarrh.'

"(b) Such antecedent condition of catarrh is induced by depleting physical conditions and not by direct transference of infection from horse to horse.

"(c) Throughout the clinical course of such cases a specific organism is present probably in all, but certainly in the majority of instances, both in the circulating blood and in tissues after death.

"(d) The blood of animals suffering or recovered from either of these diseases acquires a specific property capable of clumping or agglutinating strongly the bacillus in question.

"The conclusion drawn is that an essential connection exists between the ordinary catarrhal and pneumonic attack and the organism which later although usually non-pathogenic to the normal horse, is capable, in circumstances of lowered vitality, of establishing a pathogenic action ultimately leading to grave tissue involvement. . . ."

The organism referred to above and styled the bacillus "*x*" is stated to resemble closely *B. subtilis*, an organism which is usually regarded as being non-pathogenic. The author, however, claims that there are "certain points of difference in morphology and culture" between these two organisms and details regarding the biological characters of the incriminated organism are promised in a later report. This organism was found in pure culture in "57 per cent. of cases in the circulation of the living animal when suffering from catarrh" . . . "in the sporing condition as well as in the resting stage." [No sign of sporulation is visible in the organisms depicted in photomicrograph 1 and stated to be in the sporing condition.—Ed.] The organism was also generally found in pure culture in the pleural membrane and sublying exudate on the surface of the lung in cases which had apparently not reached the so-called septic stage. "Even in the advanced septic stage the bacillus, which appears to be the primary causal organism, can be isolated without difficulty owing to its great resistance to a degree of temperature which kills the other organisms."

"This same organism is present occasionally in the circulating blood of horses not the subject of any catarrhal condition and apparently in normal health," but it is believed that the normal circulating blood does not harbour it indefinitely and that its presence in such cases must be looked upon as a pathogenic phenomenon; animals harbouring this organism are regarded as disease carriers.

The organism presented a striking peculiarity in that it could only be isolated in culture when horse flesh or serum, instead of the usual beef products, was used in the preparation of media.

"The presence of agglutinins in the blood of the horse suffering from, or recovered from, catarrh is demonstrable to a marked degree" and "the agglutinative principle is absent from young equines or only present to a modified degree." [We wonder what the significance of a modified degree of agglutinative principle can be.—Ed.] "That this agglutinative power is not entirely dependent on previous catarrhal attack, however, would seem probable from the agglutination of the normal ox and sheep, which although not high, is distinctly present. Such differences between the horse and the ox would appear likely to be due to the presence in the tissues of the former of some substance of a bio-chemical nature, permitting the more vigorous development of the organism in question." [A very comprehensive although extremely vague statement.—Ed.]

In giving a brief sketch of what he considers the pathological and clinical picture of the disease the author states *inter alia* (para. 41) "congestion of the lung tissue . . . is attended with embolism and occlusion, and by the lodgment of the organism in the ultimate air passages where the optimum conditions of warmth, stillness, and an adequate supply of oxygen ensures its vigorous proliferation. . . ." However, earlier on (para. 35), in discussing the pathology of the so-called "septic" condition he states that this appears always to be of the nature of a secondary invasion due to "a septic environment such as most stabled horses are liable to. Recognition of this fact obviously furnishes the *rationale* underlying open air treatment of pneumonia where an increased opportunity for oxygenation and freedom from septic environment often prevents the grave condition which ensues in cases where the tissue of the lung becomes septic." [Oxygenation is thus both a markedly deleterious and a beneficial process in that it on the one hand stimulates the growth of the alleged causal organism and on the other hand inhibits a "septic" condition.—Ed.]

The author deals finally with the transmission of the disease and his experience leads him to state that "transference by contact, both of pneumonia and the ordinary form of catarrh, appears to fail. Moreover, "the lighter class of horse possesses a considerable degree of immunity as compared with the heavy draught type."

[In this connection more especially it is unfortunate that the protocols of the experiments do not accompany the text inasmuch as they were omitted by the Editor of the journal in which the report is published as they were too voluminous for reproduction. They would in reality have been of fundamental value in judging the merits of the work. It is obvious that the author attempted to carry out his experiments in about the worst possible circumstances. The animals which passed through his hands necessarily possessed no history regarding previous infection and no knowledge could possibly have been obtained regarding their previous history of freedom from infection or infective environment. Satisfactory work could only have been done if such knowledge had been obtainable and proper facilities for isolation and careful observation had been furnished on a scale far more extensive than is obtainable at an ordinary laboratory.—ED.]

REPORTS.

GOLD COAST. **Report of the Accra Laboratory for the Year 1916.** J. W. Scott MACFIE, Pathologist. 115 pp. London: J. & A. Churchill. (pp. 23-28.)

Examinations of Various Animals.

"The routine blood examinations of the animals brought to the slaughter-houses was discontinued in 1916, owing to the reduction of the Staff occasioned by the continuation of the war. No returns have therefore been made of the parasitic infections occurring in the animals slaughtered at Accra; but as this subject was thoroughly investigated in 1915 the omission was a welcome one, because the time that would have been spent over the examinations was able to be devoted to other work.

"Various animals, however, have been examined at the laboratory during the year, namely, 14 antelope, 3 bats, 19 birds, 12 cats, 5 cattle, 16 dogs, 2 fish, 1 frog, 4 goats, 1 hare, 2 hedge-hogs, 18 horses and mules, 4 hyaenas, 1 leech, 1 lizard, 3 pigs, 36 rats, 3 sheep, 10 snails, 5 snakes, 11 toads, and 2 wart-hogs: 173 animals in all. No parasites were found in the blood of the bats, cats, fish, frogs, goats, hare, hedge-hogs, hyaenas, leech, lizard, pigs, sheep, and wart-hogs.

"A large number of intestinal worms and other parasites were collected from these animals, but these are not referred to below, as no attempt has yet been made to identify them. A considerable number of other animals were also examined for intestinal spirochaetes.

Antelope.

"The 14 antelope examined were five duiker, three hartebeestes, two oribi, one reedbuck, two roan, and one water-buck. Eleven of the specimens were blood films sent by Dr. J. J. Simpson from Yapi, and one a blood film sent by Dr. Allan from Gambaga. Parasites were found in three, namely, a hartebeeste, an oribi, and a reedbuck, all from Dr. Simpson.

"In the blood of the hartebeeste (*Bubalis major*) a few small piroplasms were found which exactly resembled the organisms so common in cattle in West Africa and which are generally known as *Theileria mutans.* Only ring forms were found. In the blood of the oribi an exactly similar infection was found. No Koch's 'blue bodies' were seen in either animal.

"An apparently similar parasite was found by Todd and Wolbach in a roan antelope in the Gambia ('Jl. of Med. Research,' 1912, Vol. 26, p. 195), and the name *Theileria hippotragi* was proposed for this species. The organisms found in the blood of the hartebeeste and oribi referred to above did not differ in any particular from those commonly seen in cattle in the Gold Coast, and as they may have been the same parasite it seems unnecessary to distinguish them by special names.

"A few trypanosomes were found in the blood of the reedbuck. These were polymorphic organisms, and may have been either *T. pecaudi,* the common cattle species, or *T. gambiense,* the human parasite. No forms were found with posteriorly placed nuclei, but this does not really assist in the identification, as such forms, which occur in *T. pecaudi* but not in *T. gambiense,* are very rarely found except after inoculations into the small laboratory animals, such as rats or guinea-pigs.

Birds.

"The 19 birds examined included four swallows, two pigeons, one guinea-fowl, nine domestic fowls, one sparrow, and two other small birds. The only infections found were in the sparrow and the domestic fowls.

"The single sparrow examined was found to be heavily infected with an endoglobular parasite, probably *Haemoproteus danilewski.*

"Spirochaetes, *S. marchouxi,* were found in the blood of seven out of the nine domestic fowls sent for examination.

Cattle.

"A very interesting piroplasm was found in blood films from a cow sent to the laboratory by Dr. E. W. Graham from Tamale, but as this parasite is still under investigation an account of it will have to be deferred.

Dogs.

"Two of the dogs examined were infected with *Babesia canis,* and one of them, a rough-haired terrier, was kept under observation for some weeks and was treated with trypanblau with good results. This dog when first seen was completely paralysed in its hind legs. Under treatment this gradually passed off, but it remained well marked long after all parasites had disappeared from the blood.

"Polymorphic trypanosomes were found in one dog. The animal was said to be very lethargic and always sleeping, he appeared to be unable to recognise familiar voices, he had to be moved forcibly from place to place, and when roused he stood with his legs widely separated. The parasites were probably *T. pecaudi,* but as no posterior nuclear forms were found, and in the absence of inoculation experiments, it is possible that they may have been *T. gambiense.*

"Sheathless filarial embryos were found in one dog.

"Ten dogs were dissected during the year. One animal, which had been found in a moribund condition, had an intussusception of the small intestine. The invaginated part of the gut was gangrenous, and immediately below the site of the intussusception there were innumerable small tapeworms. In another dog, which had been shot because it appeared to be in great pain, the appendix was found to be twisted like a corkscrew and inflamed.

Ankylostomiasis of Dogs.

"In 1915 Yorke and Blacklock recorded the occurrence of *Ancylostoma caninum* and *A. ceylanicum* in dogs at Freetown, Sierra Leone, an infection which they found to be present in all the seven animals they examined ('Annals of Trop. Med. and Parasitol.,' Vol. 9. p. 425). This observation, interesting enough in itself as it is, has a special bearing on human pathology, because one of the parasites, *A. ceylanicum,* has been found in other parts of the world (India, Siam) in the intestine of man.

"The ten dogs dissected at Accra in 1916 were therefore examined carefully for ankylostomes, and four of them were found to be infected.

In each case the species found was *A. ceylanicum*. The dogs at Accra appeared therefore to be less commonly infected with ankylostomes than those at Freetown, and in the ten individuals examined *A. caninum* was not identified.

"Leiper ('Jl. R. Army Med. Corps,' Vol. 24, p. 569) has suggested that Yorke and Blacklock were mistaken in their identification of *A. ceylanicum*, and that they were really dealing with *Uncinaria stenocephala*, a similar ankylostome often found in association with *A. caninum*. The buccal cavity of *Uncinaria stenocephala* is furnished with cutting plates but no teeth, and the dorsal ray ends in three deep digitations, so that a confusion between the two parasites would appear to be almost impossible, and the figures which illustrate the paper by Yorke and Blacklock seem to justify their identification.

"The specimens of *A. ceylanicum* collected at Accra conformed to the description of Yorke and Blacklock and of Lane ('Ind. Jour. Med. Research,' Vol. 4, p. 74), which referred to parasites from Sierra Leone and India respectively. I have been permitted by Professor Stephens to examine some examples of *A. ceylanicum* sent from India by Major Clayton Lane, and have found that they closely resembled those brought from Accra, but appeared to have a narrower dorsal ray. The dorsal rays, however, terminated in three digitations, and not in two, as figured by Leiper.

"In the small number of dogs dissected at Accra, *A. caninum* was not found. Some ankylostomes collected from dogs at Lagos and sent to Professor Stephens in 1913 were identified as *A. caninum*, and recently on re-examining these materials no specimens of *A. ceylanicum* were found. It would be interesting to ascertain by further dissections if *A. caninum* occurs at Accra and *A. ceylanicum* at Lagos.

"One of the dogs found to harbour *A. ceylanicum* had been kept at the laboratory since it was a puppy—that is, for about a year. On 21st January he was noticed to be getting very thin and lethargic, and his blood was therefore examined, but no parasites could be found and no auto-agglutination of the red corpuscles such as occurs in trypanosomiasis. It was noted on this occasion that no eosinophile leucocytes were seen. On 1st February he was again examined, as he was getting worse and was very anaemic. No blood parasites were found. From this time the dog rapidly wasted, and died on 9th February. Blood taken just before death showed no parasites, no eosinophile leucocytes were seen, and a differential leucocyte count (500) gave the following result:—

Polymorphonuclears	84·2 per cent.
Mononuclear cells	15·6 ,, ,,
Eosinophiles	0·0 ,, ,,
Basophiles	0·2 ,, ,,

"On dissection the tissues were found to be very pale, indicating an advanced condition of anaemia, but no gross lesions were found. Both the liver and spleen were enlarged, but smears showed no parasites. Three tapeworms, one *Ascaris*, and a large number of ankylostomes were found in the intestine.

"This case would seem to prove that ankylostomiasis may be a serious disease in dogs, although no doubt, as in man, the parasites may sometimes be present without producing appreciable symptoms of illness.

"As has already been stated, *A. ceylanicum* has not yet been found as a human parasite at Accra, but very few examinations have as yet been made, and the question requires further investigation.

Horses and Mules.

"Trypanosomes were found in two of the horses examined, namely, *T. vivax* in one and *T. congolense* in the other. Neither of the infections occurred at Accra, the blood film from the first having been sent to the laboratory from Gambaga by Dr. Allan, and that from the second from Yapi by Dr. Simpson.

"One mule examined at Accra by Dr. Ingram in December was infected with a polymorphic trypanosome, probably *T. pecaudi*.

Rats.

" Most of the rats examined (32) were Black Rats (*Epimys rattus*) sent to the laboratory by the Medical Officer of Health but in addition one Pouched Rat (*Cricetomys gambianus*) was examined and three field rats with white bellies and reddish sides of an undetermined species. All the animals were captured at Accra.

" Grahamella bodies were found in eleven of the Black Rats , the Pouched Rat, and two of the field rats. A Bass culture was made with the heart blood of one Black Rat showing these bodies. No increase in the number of bodies was observed, but after 24 hours in some of the cells they were seen to be collected at one side. The bodies were still recognisable on the fourth day, when the experiment was discontinued.

" *Trypanosoma lewisi* was found in six of the Black Rats, and the piroplasm, *N. decumani*, in four Black Rats and two field rats.

" A mite disease to which the experimental white rats were subject is described elsewhere.

Snakes.

" Haemogregarines were found in the blood of two of the five snakes examined, and Dr. Ingram found a *Haemacystidum* in another specimen.

" In addition to these specimens some very interesting materials have been received from Dr. J. E. L. Johnston (Northern Nigeria) and Dr. Corson (Lorha), which unfortunately it has not yet been possible to study. The materials consisted of blood films from snakes showing inclusions in the red corpuscles similar to those which occur in toads, figures of which were given in the Laboratory Report for 1914 (Plate I, figs. 60–62) These bodies are without doubt the same as the ' unidentified Parasite ' found by Dutton, Todd, and Tobey (' Annals of Trop. Med. & Parasitol.,' Vol. 1, 1907, p. 287) in a puff-adder caught in the Gambia and in frogs and toads caught in either the Gambia or the Congo, and the same as those found by França in toads from Portuguese Guinea, which he has described under the name *Toddia buffonis* (' Archiv. do Inst. Bacter. Camara Pestana,' III, Fasc. II, p. 229).

" Dr. Johnston's materials also showed a pigmented intra-corpuscular parasite of considerable interest, and a trypanosome.

Toads.

" Eleven specimens of the common toad (*Bufo regularis*) were examined, all in January, but no new parasites were found. Eight of the toads harboured the usual large haemogregarine, and four *T. rotatorium*, a single examination only being made in each case. Three of the animals showed the inclusions referred to above as *Toddia buffonis*."

Assam. **Report of the Civil Veterinary Department for the Year 1916-1917.** [Harris (W.)]—19 pp. f'cap. With 8 tables. 1917. Shillong: Assam Secretariat Printing Office.

A considerable part of this report is taken up with details regarding general administration and veterinary instruction of Government stipendiaries at the College.

The number of deaths from contagious diseases reported in the various Provinces during the year 1916-1917 was as follows :—

Equines—glanders 2, anthrax 42, surra 26, dourine nil, other contagious diseases 192. Bovines—rinderpest 20,817, foot-and-mouth disease 5,737, haemorrhagic septicaemia 4,245, blackquarter 241, anthrax 1,839, other contagious diseases 12,073. Other animals—rinderpest 498, foot-and-mouth disease 617, haemorrhagic septicaemia 459, blackquarter 61, anthrax 76, distemper 160, rabies 49, other contagious diseases 798.

During the year preventive inoculations by the "serum alone" method were carried out against rinderpest, anthrax, and haemorrhagic septicaemia. The number of inoculations compared with those of the preceding year shows a decrease which is due partly to the smaller number of outbreaks reported and to the reduction in the number of veterinary assistants.

Rinderpest.—Inoculation was carried out in 348 outbreaks in 19 divisions. In these outbreaks 9,633 animals died before inoculation; 29,986 animals were inoculated, of which 571 animals died after inoculation.

Anthrax.—67 outbreaks of suspected anthrax were reported and the disease was definitely diagnosed by microscopic examination in 59 outbreaks. Inoculation was carried out in 47 outbreaks; in these outbreaks 471 animals died before inoculation and 3,811 animals were inoculated, of which 6 died subsequently of the disease.

Haemorrhagic Septicaemia.—Specimens were received from 20 suspected outbreaks and the diagnosis was confirmed by microscopic examination in 16 of these. Inoculation was undertaken in 13 outbreaks; in these outbreaks 80 animals died before inoculation and 2,216 animals were inoculated, of which 1 subsequently died.

Dr. MACALISTER, Imperial Pathologist, Muktesar, visited the country during the year for the purpose of investigating a disease in horses known as *kumri*. This disease attacks and renders useless a considerable number of valuable horses every year and is found in every district. A number of horses were provided for purposes of investigation: MACALISTER's report has not been published. The numerous tables contain a mass of statistics regarding the prevalence of contagious diseases in the various Provinces and the administration of the Civil Veterinary Department.

BIHAR and ORISSA. **Annual Report of the Civil Veterinary Department for the Year 1916-1917.** [QUINLAN (D.), Superintendent.]—pp. 3–8. Patna: Superintendent Government Printing. Bihar and Orissa.

In this report Quinlan gives an account of a very considerable amount of field work performed by a native subordinate veterinary staff under his active supervision. This work was carried out under considerable difficulties owing to the great shortage of assistants and the opposition of the native cattle owners to inoculation and supplying information with regard to outbreaks of disease in their herds. The subordinate staff of the Civil Veterinary Department at the close of the year consisted of seven inspectors and 70 veterinary assistants, but it is hoped that a sufficient number of assistants may be forthcoming when the students from Bihar and Orissa admitted into the Bengal Veterinary College have completed their training. The number of animals treated at veterinary hospitals was 28,180, as against 26,213 in the previous year; the number treated by itinerant veterinary assistants was 55,311 as against 54,904 the previous year. The following is briefly an account of the diseases reported in the Province:—

Equines.—Two outbreaks of glanders occurred, one at Hazaribagh involving 19 cases and another at Angul, Orissa, in which 2 cases were definitely diagnosed. Fifteen deaths from surra were reported from Singhbhum. No details are available regarding other contagious diseases which caused mortality.

Bovines.—As in previous years rinderpest and haemorrhagic septicaemia were the chief causes of cattle mortality. The former was responsible for 19,144 and the latter for 5,584 out of the 26,107 deaths from contagious diseases of all kinds reported during the year. Rinderpest appeared in most of the districts of the Province, the number of outbreaks reported being 1,829, of which about half were attended to by veterinary assistants. 896 outbreaks of haemorrhagic septicaemia causing 5,584 deaths out of 7,330 animals attacked, were brought to the notice of the staff; again only about half of these outbreaks could be attended to.

Foot-and-mouth disease was responsible for 1,748 outbreaks, the number of animals affected being 39,740, out of which only 838 were reported to have died. This disease is regarded as unimportant as it does not of itself usually cause very great mortality unless complications set in.

Blackquarter occurred in 6 districts and affected 166 cattle in 12 outbreaks; there were 164 deaths. 128 deaths from anthrax out of 144 animals attacked were reported from 9 districts. 205 deaths from other contagious diseases are reported but no details are available as to the cause.

Details are given with regard to the inoculation work carried out. The scheme for inoculating cattle through the agency of a special staff of locally trained inoculators, which was introduced as an experiment in 1913, was in force throughout the year in the Ranchi district and, though the number of inoculations for both haemorrhagic septicaemia and rinderpest shows a falling off in some parts of the district, a considerable measure of success was obtained where the missionaries took an active interest in the work of the inoculators. The following table summarises the results of preventive inoculation during the year.

Name of disease.	Method of inoculation.	Number of outbreaks in which inoculation undertaken.	Number of animals which died uninoculated in course of outbreaks.	Number of animals inoculated.	Number of inoculated animals which died of the disease.
Rinderpest .	Serum alone	636	6,689	66,423	288
Haemorrhagic septicaemia.	(a) Serum	141	823	16,521	51
	(b) Vaccine	38	149	4.205	13
Anthrax .	Serum	13	42	1,759	2
Blackquarter.	Vaccine	2	1	210	Nil

In addition 8,982 animals were inoculated against rinderpest and 20,688 against haemorrhagic septicaemia under the Ranchi inoculation scheme.

British East Africa. Department of Agriculture. Annual Report of the Veterinary Department for the Year ending 31st March 1916. [Stordy (R. J.), Chief Veterinary Officer.]—pp. 62–71. Nairobi and Mombasa: Printed at The "Leader."

This report of the Chief Veterinary Officer first gives details regarding the constitution and duties of the staff of the Veterinary

Department during the year 1915–1916. The remainder of the report contains a mass of experience which cannot be extracted with justice and is reprinted as follows: –

" *Disease of Cattle.*—East Coast Fever.—Fresh outbreaks of East Coast Fever have occurred on several farms on the Uasin Gishu Plateau. A Veterinary survey was carried out there, in July and August, 1915, and it was found that, owing to the shortage of immune transport oxen caused by the Military requirements having demanded the purchase of this type of animal, it was impossible to enforce strict quarantine measures as it was necessary, to avoid grave hardship, to maintain transport in the district. There are a good number of dipping tanks already erected on the Plateau, and more are being built, so that it is hoped that it will soon be possible for all animals on the Plateau to be regularly dipped.

" Since the War began, there is evidence that East Coast Fever has spread in the settled areas, and in many cases this can only be attributed to the illicit movement of cattle from infected native reserves, such movement having been stimulated by the shortage of work oxen caused by the War.

" As a result of the heavy mortality recorded amongst cattle drawn from native reserves, collected at various military supply centres, it is evident that in the so-called infected reserves there must be large areas where the disease is non-existent. This only emphasizes the necessity for erecting dipping tanks in these reserves, to check the spread of the disease, and to safeguard the clean herds.

" During the year Government dipping tanks have been completed at Nairobi, and at Rumuruti, and a tank has been erected by the Military Authorities at Fort Ternan. Several private dipping tanks have also been erected, and some 80 are now in use in the Protectorate.

" It has been noticed on several farms where 'redlegged' ticks are prevalent, that those situated inside the ears frequently survive an immersion in the dipping fluid, and the attention of stock owners is drawn to the necessity for frequently dressing the inside of the ears of cattle infested with these ticks with a mixture of lard and Stockholm tar, in order to get rid of them.

" When dipping operations are commenced on heavily infected farms in this country it has been found that a considerable mortality occurs amongst susceptible stock during the first year. This experience is similar to what has been found to occur in Rhodesia, and differs from that of stock owners in South Africa.

" The number of cattle, the property of Settlers, admitted to the East Coast Fever Testing Area at Kamiti during the year was 587. The number of deaths was 24.

" Seventeen adult oxen drawn from the Uasin Gishu Masai Reserve were tested during the year, and all of them proved to be resistant to the disease.

" The following extract from the Government Analyst's report is of considerable interest: –

" During the year 1915, the number of samples of cattle dip analysed and reported upon was 650 against 480 in 1914. The results show no improvement upon those of the previous year as will be seen from the following table.

Percentage Error.	Percentage of Samples.	
	1914.	1915.
0—10	61·4	54·5
11—20	20·6	25·7
21—30	9·2	10·3
31—40	4·0	3·8
41—50	1·5	2·6
Greater than 50	3·3	3·1
Sufficiently correct	61·4	54·5
Dangerously incorrect	18·0	19·8

"It was anticipated that, with more experience, the dip owners would improve upon their record of 1914 in the matter of maintaining their dips approximately correct, but it is apparent from the above comparison that in reality there has been a slight falling off in the skill displayed. Probably the fact that many of the Settlers have left their farms in order to do Military service is quite sufficient explanation and, from this point of view, it is satisfactory that the results are so near to those of the previous year.

"The analytical control of numerous cattle dips in the country has not yet resolved itself into a system. It has been left to the discretion of the owner, how frequently he shall have an analysis made, so that it has happened that whereas some owners have only once or twice submitted samples for analysis others again have sent in up to 32 samples in the year.

"It sufficiently appears from the preceding classification of samples according to the magnitude of their error in strength that considerable improvement should be made in the direction of maintaining dips in a state of efficiency. It is very obvious, from a consideration of the record of individual dips, that the owners are frequently working in the dark as to the capacity of the dip and hence cannot make necessary corrections when they have been informed of their error. The consequence of this is that they immediately send a fresh sample in order to ascertain how far their attempt at correction has succeeded.

"The analysis of arsenical dips costs time and money, and this method of obtaining analysis after every correction, instead of relying upon exact calculations of volume of the dip and accurate measurement of the material added, is taking a grossly unfair advantage of the privilege of free analysis which has so far been afforded the dip owners. It has been conclusively proved that this method of correction by trial, instead of by calculation, is not only expensive to the State, but is also unsuccessful.

"Steps are being taken to encourage the dip owner to acquire an intimate knowledge of the capacity of his dip, and to take a lively interest in the accurate measurement of all intentional and accidental additions and subtractions, and to discourage him from attemptimg to place upon the State the burden of maintaining his dip efficient.

"Attention in previous reports has been drawn to the changes in composition which dips undergo, particularly to the processes of oxidation and reduction.

"There appear to have been about 76 dips under observation during the year—the exact number is doubtful as samples from the same dip are sometimes sent over different signatures and the tracing of these is difficult—and in 47 of these the oxidation has not been very great, the quantity of arsenate formed not having at any time exceeded 25 per cent. of the amount of arsenite present. In 18 dips the arsenate reached a maximum exceeding 25 per cent. but not exceeding 50 per cent. of the arsenite, and in all dips a maximum of arsenate exceeding 50 per cent. was reached. In one case oxidation proceeded so far that there was actually at one period over 2½ times as much arsenate as arsenite present. The cycle of oxidation and reduction was in one case completed twice in the year, in two cases it took approximately nine months; several cases indicated a complete cycle in about 12 months, while in many cases the course of the changes was irregular, and the oxidation did not steadily proceed to a maximum followed by a continuous reduction.

"It has occurred in many cases that a dip has been kept in use long after it has become filthy and thick with dung and mud. There are not lacking indications that these dirty dips are inefficient, even when the analysis indicates a satisfactory arsenic content.

"It is highly probable that compounds of iron with arsenic are formed which have practically no toxic properties. Perhaps further experience will enable a more definite statement to be made as to the amount of mud, etc., which may be tolerated. Several cases of error in sampling have occurred—tins which have been used for measuring out Coopers dipping Fluid have been immediately afterwards used to take a sample from the dip; bottles with a quantity of rinsing water left in have been filled up with the sample, etc. Cases have occurred where the results of analysis have given great surprise to the dip owners, and explanations have been demanded of the Analyst. In these cases the usual sources of error in sampling have been pointed out, and the owner has sometimes recognised one or other as the probable explanation, in other cases no explanation has been forthcoming excepting that some serious miscalculation has been made in making up the dip.

"Rinderpest.—Outbreaks of this disease occurred during the year in the settled areas of Lumbwa, Molo, Londiani, Njoro, Nakuru, Naivasha, Kedong, Ngong, Nairobi, Thika and Machakos. In suppressing these outbreaks the double inoculation method was used at Molo, Nairobi, Thika and Machakos. The other outbreaks were dealt with by the inoculation of serum only. The mortality from double inoculation has proved to be as small as in previous years and there is no doubt that this is the best method for dealing with the disease in this country, owing to the constant danger of the disease being reintroduced from infected native reserves, or through the migration of infected wild game.

"In September, 1915, the Veterinary Pathologist reported that instances had come under his notice which went to prove that the double inoculation of calves under six months old did not always result in the production of a permanent immunity to Rinderpest. A circular letter was therefore issued to all Veterinary Officers informing them that calves which are double inoculated for rinderpest when under the age of six months should not be considered immune and consequently should not be branded A M (this brand signifying active immunity). At a later period when such calves are over six months old they should be again double inoculated and branded as immune.

"A fresh outbreak of Rinderpest occurred amongst the cattle of the Samburu tribe, Northern Frontier District. A temporary quarantine station was therefore formed at Archer's Post and all trade cattle, awaiting release there, were injected with serum and passed on to Rumuruti Quarantine Station where they were again serumed before being passed on to the settled areas.

"At the Fort Ternan Quarantine Station 1,367 Military cattle and 2,328 cattle, the property of settlers and traders, were double inoculated during the year.

"The Laboratory issued the following quantities of serum during the year:—

To Military Authorities, East Africa	42,352
„ „ Uganda	10,080
Veterinary Department, E.A. Protectorate ..	34,810
„ „ Uganda	25,032
Settlers and Traders	3,500
Government of Nigeria	10,080
Total ..	125,854

"Anthrax.—Several cases of this disease occurred at Fort Ternan Quarantine Station amongst cattle undergoing quarantine after double inoculation for Rinderpest. The infection in many cases appeared to take place at the site of inoculation and in some cases infected animals lived for 20 days after developing symptoms. There is strong evidence to show that animals may be infected with the bacillus of Anthrax without clinical symptoms of the disease being apparent, and it has been demonstrated, that while this bacillus may be innocuous or at least non-fatal to a number of indigenous animals, the same bacillus may prove highly fatal to others.

"It is by this factor that we might assume Anthrax is carried from animal to animal in the process of double inoculation for Rinderpest. Many no doubt will miss infection, others though infected do not sicken, while others, again, contract Anthrax and die. Cases of anthrax also occurred amongst transport cattle working on the Mumias-Kisumu Road, and in the Nairobi and Kyambu Districts. As this disease is communicable to man and proves frequently fatal, animals intended for human consumption should be carefully inspected and temperatured before slaughter.

"Pleuropneumonia.—A few cases of Pleuropneumonia came under notice among the stock confiscated from the Turkhana. The precautions taken prevented animals from being moved to the settled areas.

"With regard to the quarantine area for this disease in the Masai Reserve every possible precaution is being taken to prevent the spread of the disease from this area, but owing to the large purchases of slaughter oxen which are being made from the Masai for Military purposes the owners of the infected herds may be tempted to evade quarantine restrictions and sell infected animals to the Military.

"Tuberculosis.—No cases of Tuberculosis have been reported this year.

"Contagious Abortion of Cattle.—This disease has come under notice on a few farms in the Molo, Nairobi, Naivasha and Machakos Districts, but it is of such an insidious nature and usually pursues such a mild course in native cattle that it is highly probable that it will be found to be much more widespread than is at present suspected. The disease spreads from farm to farm through infected cattle changing hands and too often unscrupulous farmers conceal the fact that their herds are infected to enable them to dispose of their stock. On the other hand, owing to the mild course it usually follows in native cattle, the disease may be present in a herd without the owner having suspected its existence.

"In Europe and other countries contagious abortion is a very serious disease from the stock breeders' and dairy farmers' point of view, and is the cause of enormous losses to owners of infected herds.

"It is probable that the disease in this country will be found to be a most serious one, should it appear in herds of grade cattle. It is therefore highly advisable that all cattle breeders should take every precaution to safeguard their herds against the disease. Rigorous preventive measures enable the disease to be effectually controlled only in herds that are well looked after, and experience in Europe and other countries goes to prove that for the present, effective legislation cannot be devised.

"The most practical method of preventing the introduction of this disease on to a farm is to submit all newly purchased breeding animals to some months' quarantine on an isolated portion of the farm before they are allowed to commingle with the animals of the homestead.

"In calf cows purchased should be calved down in isolated kraals and not allowed to leave these kraals until the animals have returned to normal health and all uterine discharge has ceased. Only then, after careful disinfection of the cows, should the stud bull be allowed access to them.

"A pamphlet dealing with the whole subject will shortly be issued by the Department.

"Trypanosomiasis.—An outbreak of Trypanosomiasis occurred in June, 1915, amongst settlers' cattle in the Thika District. A Veterinary survey was carried out over the whole district in July and August, when it was found that the disease was being largely disseminated through the agency of the common bloodsucking cattle fly (Stomoxys). The area implicated was placed in quarantine in September, 1915, and since then a Veterinary Officer has been permanently retained in the district, carrying out periodic examinations of all cattle; destroying all animals found to be affected with the disease. The measures to date have been instrumental in reducing the incidence of the disease and there is reason to believe that the disease will be eradicated along the transport routes in the near future when it will be possible to allow freer movement of cattle in the district.

"Foot and Mouth Disease.—An outbreak of this disease occurred at the Laboratory amongst cattle imported from Uganda. Prompt action was taken to segregate the affected herd, and any danger of the disease spreading to the Native Reserve was prevented, through the kindness of the Officer Commanding the Nairobi Defence Force, who kindly supplied an armed guard to patrol the infected area.

"This outbreak gave the Veterinary Pathologist an opportunity to satisfy himself in regard to the virulence of the Uganda form of this disease. It proved to be of a very benign type, and local stock possess a considerable resistance to it.

"Quarter Evil.—Outbreaks of Quarter Evil have been reported in Nyeri, Lumbwa, Nakuru and Kisumu Districts. A vaccine produced at the Laboratory has been used and has given good results.

"*Diseases of Equines.*—Glanders.—Cases of Glanders have occurred in one or two consignments of remounts from South Africa. By application of the Mallein test all affected animals were promptly discovered and destroyed.

"There should be little fear of this disease remaining in the country on account of the care that is being exercised to control and eradicate it.

"Epizootic and Ulcerative Lymphangitis.—It is gratifying to find that very few cases of Epizootic Lymphangitis were noted during the year and there has been a great diminution in the number of Cases of Ulcerative Lymphangitis also. This decrease is mainly due to the fact that practically all the equines in the country came under Veterinary inspection during Military commandeering operations when most of the affected animals were either destroyed or sent to the Laboratory for treatment.

"There are a number of equines infected with Ulcerative Lymphangitis, however, still on the Uasin Gishu Plateau.

"The organism of Ulcerative Lymphangitis is present in the soil throughout the Protectorate. No good cause could be served by keeping this disease on the Schedule of notifiable diseases, and steps were taken to delete this disease from the Diseases of Animals Ordinance.

"Horse Sickness.—This disease was the cause of considerable mortality among Military remounts in the Nairobi, Mbagathi and Bissel Camps.

"Few cases have been reported by farmers during the year but this is probably not due to the disease being less prevalent than formerly, but because owing to the War, fewer animals are to be found on the farms.

"Strangles.—Several consignments of remounts from South Africa arrived at Kilindini infected with Strangles, the disease proving to be of an unusually virulent type. As great care is exercised to prevent any affected animals being sold at the sales of remounts there should be no risk of this disease appearing on farms.

"*Diseases of the Sheep and Goat.*—The principal diseases of the sheep and goat which have come under our notice during the year in the Military flocks have been Nairobi Sheep Disease, contagious foot-rot, verminous gastro-enteritis and contagious pleuro-pneumonia of the goat.

"*Diseases of the Pig.*—Two outbreaks of suspected East African Swine Fever were reported from Nyeri and the Uasin Gishu Plateau, respectively, but these were not confirmed.

"*Diseases of the Dog.*—An outbreak of suspected Rabies was reported from South Kavirondo, but the Veterinary Department had no opportunity to confirm the diagnosis.

"An outbreak was reported from Limoru, but as the suspected animals had been promptly destroyed, a diagnosis was not made."

A few details are added giving statistics regarding the permit system, live-stock importation, trading, branding of stock, together with some general remarks.

BRITISH EAST AFRICA. **Department of Agriculture. Annual Report of the Veterinary Pathologist for the Year ending 31st March 1916.** [MONTGOMERY (R. Eustace).] pp. 72–75. Nairobi and Mombasa. Printed at The "Leader."

Unfortunately the greater portion of Montgomery's time during the year under consideration was taken up with work of military importance and thus we are deprived this year of the valuable and interesting information usually furnished in his reports. The present communication gives merely a summary of the results of the large amount of routine work performed at the laboratory. As usual the manufacture of anti-rinderpest serum was undertaken on a large scale, 204,480 doses being prepared during the year.

GOLD COAST. **Report on the Veterinary Department for the Year 1916.** --[O'DEA (M. E.), Acting Veterinary Officer).] 8 pp. f'cap. 1917. Accra: Government Press.

In the absence of a trained veterinary officer the work of the Veterinary Department for the year under consideration was carried out by a small staff under the supervision of a medical officer. This work consisted mostly in the routine inspection of cattle, sheep, and goats arriving at Coomassie, either for slaughter or transportation by rail or road to other towns near the Coast. A small amount of investigation work in connection with outbreaks of anthrax and rinderpest was performed by the medical officers. The brief accounts given regarding the diagnosis and methods of dealing with these diseases show a lack of trained knowledge regarding diseases of animals. A small outbreak of what was probably anthrax among stock passing through Salaga on their way from the Northern Territories was dealt with, apparently successfully. Numerous deaths occurred among horses and cattle travelling from the French dominions through the Northern Territories to the Coast; this epizootic was investigated by a medical officer who reported that this outbreak and other outbreaks in these regions could only be put down to rinderpest. The mortality, however, was much lower than that usually occurring in outbreaks of rinderpest in Europe and in the Transvaal. In spite of the presence of this disease along the cattle routes of the Northern Territories throughout the greater part of the year with its attendant mortality and dislocation of the cattle trade the number of cattle imported into Coomassie for 1916 was 14,799 as against 9,802 for 1915.

TRINIDAD and TOBAGO. **Report of the Government Veterinary Surgeon for the Year 1916.** [MILLER, J. Duncan]. 1 p. f'cap. 1917. Port-of-Spain: Government Printing Office.

This short report gives very little information regarding the diseases prevailing in the island of Trinidad. Most of the Government Veterinary Surgeon's time appears to have been taken up with inspection of live stock imported into the island chiefly from Venezuela. A few cases of anthrax occurred among cattle imported from that country but apart from that disease and strangles in American mules no contagious disease was observed in the imported animals. The island is free from rabies. The diseases observed in the island are stated to be for the most part due to metazoan parasites. A few cases of anthrax have occurred and several outbreaks of influenza among horses. A few details with regard to the prevailing diseases would be interesting.

UNION OF SOUTH AFRICA. **Department of Agriculture. Report of Veterinary Division. 1915-1916.** [GRAY (C. E.). Principal Veterinary Officer.] (Abridged Report in *Vet. Record.* 1917. Nov. 24. Vol. 30. No. 1533. pp. 209–213).

East Coast Fever.—This disease still constitutes the most important problem dealt with by the Veterinary Division and consideration of its distribution in the various Provinces and the means adopted for its eradication embrace about half of the present report.

In the Cape the position with regard to the disease has distinctly improved, the number of infected areas still remaining under quarantine having been reduced to six, included in two districts, and as there has been no serious mortality in these areas during the past twelve months there appears to be good reason for hoping that the disease will shortly be eradicated also from these districts.

In the Transvaal there are 8 districts infected with the disease but in most of these the infected areas are more or less circumscribed.

In Natal the position is by no means so favourable; the disease is so widely distributed that 28 magisterial districts are infected and only 6, which form a comparatively small portion of the total area of the Province, are shown as free from the disease. The situation is perhaps explained by the fact that although dipping tanks have been erected in very large numbers by the farming community this has been done in many cases not so much because the value of dipping has been appreciated but for the purpose of obtaining permits for the movement of cattle. Satisfactory progress is being made in the provision of dipping facilities in the native areas of Natal but the difficulties involved in dipping in such conditions are very considerable.

In the Transkei Territories the operations undertaken for the eradication of the disease in native territory have not yet reached a stage at which good results can be reasonably expected. Difficulty has been found in evolving a system which will induce native owners to dip their cattle. The disease, however, appears to have diminished, there having been only 31 fresh outbreaks as compared with 58 last year. In many districts the mortality amongst adult cattle is no longer serious because most of them have become immune either through inoculation or through having contracted the disease when young, but in all districts in which the disease has become established there is a heavy mortality among young stock, varying from 30 to 80 per cent., which keeps up veld infection and perpetuates the disease. In those districts in which European farmers have settled the position is better.

Dipping operations were seriously interfered with throughout the Union on account of the high price of dipping material; arsenite of soda was at one time unprocurable and thus for a time the dipping of cattle in infected areas was in danger of coming to a standstill. In the Cape Province there is a very unfortunate lack of interest in the erection of dipping tanks considering the constant liability to invasion with the disease. The position in the Transvaal is not better, although very considerable losses have been caused in the past. In Natal the number of tanks erected is relatively very much greater, though still insufficient, and it is hoped that in time the majority of farmers will appreciate the benefits of cattle dipping as a reward for their enterprise. In the Transkei the erection of tanks proceeds steadily; in the Orange Free State the number of tanks has also been nearly doubled.

Tuberculosis.—This comes next to East Coast fever in order of economic importance. Legislation has been introduced both for empowering the application of the tuberculin test overseas in the case of animals intended for import and also for dealing with reacting animals already imported from overseas. There is still a lack of co-operation between stockowners and the authorities which tends to defeat all efforts made by the Department to deal in a satisfactory manner with outbreaks of disease. Details are given concerning the methods employed in dealing with outbreaks in the various provinces.

Anthrax.—The losses from this disease are believed to be even greater than those due to gall-lamziekte, which, however, engages the attention of farmers far more considerably. It is pointed out that the former is nevertheless a preventible disease which can be controlled and stamped out by inoculation. In the Cape Province the disease is extending and as no determined effort is made for its suppression the losses will probably be greater than they have been in the past. The employment of vaccins has in some instances been resorted to but much too late in the scene of outbreaks. It is also believed that better success would attend inoculation by increasing the volume of the doses. In the Transvaal and Orange Free State anthrax is becoming increasingly prevalent while in Natal and in the Transkei the losses have not been heavy.

Glanders.—The number of outbreaks recorded and dealt with were as follows :—Cape 22, Transvaal 63, Natal 9, Transkei 5, and Orange Free State 6.

Lung sickness.—There were no fresh outbreaks in the Cape Province. In the Transvaal there was one outbreak : 2 animals were destroyed and found to be infected but no further cases occurred among the in-contacts. In the Transkei two outbreaks were dealt with, neither of which was of much importance, only 3 animals being infected.

Equine scabies (mange).—In the Cape this disease was very prevalent in the vicinity of Port Elizabeth, but otherwise it gave very little trouble. In the Transvaal there were 5, Natal 11, Transkei 14, and Orange Free State 4 outbreaks.

Epizootic lymphangitis.—In the Cape five infected equines were destroyed ; in the Transvaal one animal was found infected and in Natal there were five outbreaks. The position so far as this disease is concerned has greatly improved of late years.

Contagious abortion.—The number of outbreaks reported was 31, distributed in Transvaal 8, Natal 10, Transkei 8, Orange Free State 5. The distribution and character of the disease is, however, admittedly very little understood, and no satisfactory method of dealing with it has been evolved.

Trypanosomiasis.—This does not appear to have spread to any extent outside the fly area.

Some short notes on the following non-proclaimed diseases were furnished by the Senior Veterinary Officer, Capetown [Dixon (R. W.)].

Blue-tongue in sheep.—This does not seem to have been very much in evidence except in the Western Province where in parts it was very prevalent. The diminution in frequency of the disease was attributed to the scarcity in rainfall during the year.

Ephemeral fever (*Three days' sickness*).—This disease was prevalent throughout the Province and in some districts it was particularly severe, as many as 40 to 50 animals in a herd being attacked at one time. Very few cases proved fatal.

Lamziekte.—Appears still to be confined to the sour grass veld area and cases among milch cows and heifers in calf make their appearance during prolonged drought.

Geel-Dikkop.—"This disease, which attacks both sheep and goats and is mainly confined to the Karroo districts, was prevalent this summer in the

Northern and North-Western Karroo districts, causing considerable mortality. It appears about the same time as blue tongue, although it is observed that, unlike blue tongue, when the rains are copious and persistent, geel dikkop is not so prevalent. Repeated rain showers followed by hot days are the weather conditions most favourable for its development.

"All attempts to produce the disease by inoculation have failed, also feeding experiments with suspected plants. As the true nature and cause of Geel-Dikkop are unknown, it is hoped that the Director of Veterinary Research will, by investigation, elucidate the cause.

"Medical treatment is found successful when the affected animals are treated early. . . .

"Geel-Dikkop has also been rather prevalent in the Orange Free State. There has been no opportunity of making any investigation respecting the so-called White Liver in sheep.

"*In the Transkei* the past horse-sickness season has been remarkably mild. The same applies to blue tongue. A peculiar form of bone disease in donkeys occurring in East Griqualand is now being investigated by the Research Division."

Further details are added concerning the duties and position of the Staff of the Veterinary Division.

BOOK REVIEWS.

LAVERAN (A.). **Leishmanioses. Kala-azar. Bouton d'Orient. Leishmaniose Américaine.**—iii + 521 pp. With 40 text figs. and 6 plates (2 coloured). 1917. Paris: Masson et Cie. [Price 15 francs].

Although 14 years only have passed since the discovery of *Leishmania donovani* and *L. tropica* a very large number of papers have been published on these protozoa and the diseases produced by them; these articles are, however, to be found distributed throughout a large number of periodicals which are often only obtainable with difficulty. Laveran thus believes that the time has come to summarise our actual knowledge concerning the leishmaniases. The present work is set out according to the following plan:—

(1) Leishmania and leishmaniases in general.

(2) Human visceral leishmaniasis or kala azar, caused by *Leishmania donovani*; infantile kala azar, which was formerly considered by a large number of observers as a morbid entity, is identified with Indian kala azar.

(3) Naturally-occurring canine visceral leishmaniasis, probably of the same nature as kala azar.

(4) Cutaneous leishmaniasis or oriental boil, caused by *Leishmania tropica*.

(5) American leishmaniasis of the skin and mucous membranes, which is described as a variety of ordinary cutaneous leishmaniasis or oriental boil.

As can be seen from the above summary the book refers mainly to conditions of interest in human tropical medicine, whereas hitherto only one of the domesticated animals, viz., the dog, has been definitely associated with these conditions. Inasmuch as the infection of this animal, however, is probably closely connected with that of human kala azar, especially in the case of infantile leishmaniasis, Laveran considers that a study of the subject is of interest to veterinarians as well as to medical men.

The leishmaniases are not new diseases. The Aleppo button or oriental boil was known towards the middle of the 18th century while kala azar, which was described for the first time in 1882, probably had existed for a long period in the mountains of Garo in India. But, although these human diseases had been recognised clinically, their etiology was not discovered until 1903, when it was shown that kala azar and oriental boil were set up by micro-organisms, closely related to one another and belonging to a new genus of protozoa. Investigations carried out since that date have shown that leishmaniases are not rare diseases confined to a small number of districts in the tropics but on the contrary have a wide-spread distribution over the surface of the globe, not only in Asia and Africa but also in Southern Europe and a large part of South America, and probably the extent of our knowledge with regard to their geographical distribution is as yet by no means complete. Moreover, as they refer to diseases which run a chronic course and thus usually enable an affected subject to travel considerable distances opportunities may be given to observe them beyond the limits of the endemic or enzootic centres.

By far the greater part of the book refers to the above human diseases which have recently assumed considerable importance. The veterinarian will, nevertheless, find of great interest the chapter on generalities (pp. 1–44) and that on visceral canine leishmaniasis (pp. 279–303) as well as a couple of pages devoted to cutaneous natural leishmaniasis of the dog (pp. 344–346). In the chapter on generalities Laveran gives a clear and critical review of what has recently appeared in the literature concerning the history, geographical distribution, and clinical forms of leishmaniases, technique for the study of Leishmania, both by staining and by culture, and general morphology and biology of the Leishmania. The position of the Leishmania in the nomenclature of the protozoa is discussed in detail and attention is especially called to the hypotheses which suggest themselves as the result of the recent work of FANTHAM and A. PORTER [see this *Bulletin*, 1916, Vol. 4, No. 4, p. 146] and LAVERAN and FRANCHINI [see this *Bulletin*, 1914, Vol. 2, pp. 93 & 193]. According to FANTHAM and PORTER the different species of Leishmania are probably insect flagellates which have become adapted to intra-cellular life in man and other vertebrate hosts and ordinarily propagate under a flagellate form but are capable of resuming the Herpetomas form in certain conditions (for example, in culture media). "From the phylogenetic point of view the relationship between Herpetomas of insects and Leishmania does not appear to be in doubt as can be judged from these experiments. From the point of view of nomenclature, as Minchin has pointed out, the evolution of Leishmania, which are intra-cellular parasites in the vertebrate host, appears too different from that of Herpetomas, which accomplishes the whole of its evolution in the digestive tract of insects, to enable one to amalgamate the two genera."

The following few remarks on the subject of natural canine leishmaniases are taken from the preliminary chapter:—

"Leishmaniases show themselves in the dog as in the case of man under two different forms: the visceral form and the cutaneous form.

"Canine visceral leishmaniasis is much the more common form. The principal and often the only symptom is furnished by wasting; in some animals one observes towards the end of the disease paresis of the hind quarters. The spleen which is almost always increased in size is sometimes very greatly hypertrophied. The disease terminates sometimes in recovery, sometimes in death with sub-normal temperature. It is especially in the bone marrow and next in the spleen and the liver where the Leishmania are found in largest numbers. Natural canine leishmaniasis is encountered in all the regions of the Mediterranean basin where kala azar is endemic; moreover, the Leishmania of the canine infection are indistinguishable morphologically from *Leishmania donovani*; the probabilities are therefore great in favour of the identity of visceral leishmaniasis of the dog with kala azar. This statement must, however, be taken with reserve; the relationship between the frequency of canine leishmaniasis and human leishmaniasis is inconstant; canine leishmaniasis is of common occurrence in regions where kala azar does not exist, and, on the other hand, it is altogether absent in India, that is to say, in the country where human kala azar rages with greatest intensity; in addition one seldom observes dogs infected with leishmaniasis in the habitations of human subjects affected with kala azar.

"Cutaneous leishmaniasis of the dog is encountered as a natural infection in certain parts of the world; it is particularly common in Teheran and has been described in Aleppo, Turkestan, and the Caucasus. The descriptions given of this condition are very incomplete."

Experimentally the dog, the macaque, the white mouse, and some other small rodents are susceptible to infection with the viruses of kala azar and oriental boil.

It is, of course, unnecessary to discuss the merits of this book as regards style and masterly treatment of the subject dealt with. Laveran's writings are sufficiently known to all interested in tropical medicine, and the present work forms a companion volume well up to the high level set in the standard text book on "Trypanosomes and Trypanosomiasis."

J. T. E.

i. Leese (A. S.) [M.R.C.V.S. (Temporary Captain, Army Veterinary Corps. Camel Specialist to Government of India, 1907 to 1913, and to Government of East Africa Protectorate, 1913–1914)]. **"Tips" on Camels for Veterinary Surgeons on Active Service**—50 pp. (Reprinted from "*The Veterinary Journal.*") 1918. Ballière, Tindall & Cox. [Price 2*s.* 6*d.* net.]

ii. Cross (H. E.) [M.R.C.V.S., D.V.H., A.Sc. (Indian Civil Veterinary Department, Camel Specialist to the Punjab Government).] **The Camel and its Diseases. Being Notes for Veterinary Surgeons and Commandants of Camel Corps.**—viii + 151 pp. 1917. London: London: Ballière, Tindall & Cox. [Price 5*s.* net.]

The need for a small handy text-book on the more common camel diseases has now arisen owing to the employment of a number of veterinary surgeons, previously unacquainted with the peculiarities of the camel, in theatres of war where this animal figures largely as a means for transport and riding. No better authorities could have been chosen for the work than the above two authors who have been afforded ample opportunity for studying the camel in its native habitat and have already established their names in this connection on account of the reports and communications they have furnished from time to time.

i. This brochure embraces a series of articles which have recently appeared in the *Veterinary Journal.* In his preface the author states that "they were intended for the professional man, the idea being to supply such information on the diseases of camels as have not hitherto been accessible to veterinarians in a concise form, and to avoid long descriptions, both of well-known diseases like Sarcoptic mange, and of matters already quite familiar to the general veterinary practitioner; the subject is dealt with throughout on comparative lines." He concludes by saying that the "paper is admittedly only a superficial one, and has been written from memory only . . . in the back-country of Somaliland, and all my notes and records are at home. . . . No attempt has been made . . . to deal with anything but the male working camel from the point of view of the veterinary officer on active service; nor have I thought it necessary to mention certain diseases of purely local importance."

No apology need, however, be given for producing these notes at the present time and the author deserves well for placing in a condensed form the experience which he has acquired in various countries as the result of careful observation. The advice given throughout is set out in clear, unhesitating terms and should be of great value to the uninitiated in avoiding many errors which would otherwise occur. Vernacular names for diseases have been almost altogether avoided. There are signs in many places that a somewhat unnecessarily colloquial style of writing has been adopted. Indeed, perhaps the greatest possible fault of the book lies in its title. It appears quite unnecessary to place scientific advice intended for professional men on the same level as that obtainable from the parasites of a racecourse. In other places the author's expressions are somewhat ambiguous. For instance, in dealing with the surgical diseases, he includes among "the characteristic camel-lamenesses of the fore-limb" such conditions as "punctured wounds of foot" and "fracture of radius." He must surely mean that these are the "more common" and not the "characteristic" surgical diseases of camels.

It is much to be hoped that some day the author will have access to his notes and records and thus compile a more careful systematic review of camel diseases.

ii. This small volume deals with camel management and diseases in a concise, systematic and comprehensive manner. The text is aided with a number of good photographs and the publishers' work throughout has been very well done. The descriptions are apparently applicable more particularly to conditions as they exist in India and native terminology is used to a considerable extent in the text; appendices are added on the vernacular names of diseases and of fodder fed to camels in the Punjab. The chapter on camel-breeding by Major G. E. M. Hogg, Commandant 54th Silladar Camel Corps, is written in a very light, somewhat airy style and should prove of some interest. A good deal of prominence is given to the author's own recent experiments on feeding and on the attempted transmission of haemorrhagic septicaemia and blackquarter to the camel.

J. T. E.

RECENT LITERATURE.

[Continued from this *Bulletin*, Vol. 5, No. 3, pp. 214–220.]

PROTOZOAN PARASITES.

Békensky. Les Spirochètes des tractus intestinal des oiseaux. [Spirochaetes of the Intestinal Tract of Birds.]—*Bull. Soc. Cent. Méd. Vét.* July 5. *Rec. Méd. Vét.*, 1917. July 30. Vol. 92. No. 14. pp. 284–288.

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Sampson (S. E.). Coccidiosis in the Horse.—*Vet. Record*, 1917. Sept. 29. Vol. 30. No. 1525. p. 131.

[A four-year-old horse was slaughtered at Sheffield on account of emaciation, and on post-mortem examination the mucous membrane of the small intestine was thickened and the mesenteric glands enlarged and congested. The mucous membrane was found invaded with "large numbers of a coccidian parasite" which was "circular in shape" and "measured only 3 mm. in diameter." (It seems incredible that a coccidium of such dimensions was discoverable as they by no means correspond with those of the coccidia pathogenic for the other domesticated animals.)—Ed.]

Sustmann. Kokzidiose bei einem Dompfaff. [Coccidiosis in a Bullfinch.] —*Berlin. Tier. Woch.*, 1917. Sept. 27. Vol. 33. No. 39. p. 427.

Sustmann. Die Kokzidiose als Ursache des Jungtiersterbens unter den Kaninchen. [Coccidiosis as the Cause of Death among Young Rabbits.]—*Berlin. Tier. Woch.*, 1917. Aug. 23. Vol. 33. No. 34. pp. 375–376.

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Cameron (A. E.). The Relation of Soil Insects to Climatic Conditions.—*Agric. Gaz.* (Canada), 1917. Aug. Vol. 4. No. 8. pp. 663–669.

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IMES (M.). The Sheep Tick and its Eradication by Dipping.—*U.S. Dept Agric.* Farmers' Bulletin. No. 798. 1917. May. 31 pp. With 15 text figs.

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Helminths.

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TROPICAL DISEASES BUREAU.

TROPICAL VETERINARY BULLETIN.

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DISEASES DUE TO PROTOZOAN PARASITES.

BOYNTON (William Hutchins). **A Disease in Cattle in the Philippine Islands similar to that caused by *Anaplasma marginale* Theiler.**—*Philippine Jl. Sci.* Sec. B. Trop. Med. 1917. Nov. Vol. 12. No. 6. pp. 281–291. With 3 plates & 1 text-fig.

In this paper Boynton describes the occurrence of anaplasma-like bodies in the blood of three native cattle imported from Batan Island for use in connection with the manufacture of anti-rinderpest serum. On arrival at the laboratory these animals were placed in quarantine and subsequently showed a rise in temperature of from 1 to 3° C. above the average temperature of the other animals quarantined under similar conditions. They were then immediately taken out of the quarantine shed and placed with sick animals. Their blood was examined for surra parasites with negative results.

One of these animals is stated to have presented symptoms and lesions of anaplasmosis as described by THEILER and SIEBER. Twenty-three days after arrival at the laboratory it had a morning temperature of 38·6° C. and an afternoon temperature of 39·6° C. Three days later it refused food and had a depressed appearance which was still more marked after another three days, when it remained standing with its legs spread out. Its pulse was 106 per minute and its body remained covered with flies. Since no evidence of surra was found and the animal did not present the clinical picture of rinderpest, further blood examinations were made and about 30 per cent. of the red corpuscles were found to be infected with bodies similar to *Anaplasma marginale.* On the following day the animal appeared to be losing consciousness, the pulse was 98 per minute and wiry, and there was a pronounced oedema under the jaw. The afternoon temperature was sub-normal; the cow was then slaughtered as it was feared that she might die soon. On post-mortem examination the carcase showed the usual appearances accompanying marked anaemia. There was pronounced gelatinous infiltration extending along the upper part of the throat and under the jaw, the lymphatics were swollen and oedematous, the fat covering the omentum and around the intestines presented a bile-stained appearance, the gall-bladder was markedly distended with inspissated bile, the liver was very friable and of a brownish yellow colour but not appreciably enlarged, the spleen was about 1½ times its normal size and its pulp was softer than normal, the kidneys were congested and on section showed small areas lighter in colour than the remainder of the organ. The mucous membrane of the intestines was slate-coloured and streaked with bile throughout its entire length, but showed no congestion. The fourth stomach contained watery bile-stained faecal matter; the urinary bladder was markedly distended with a yellowish-brown slightly turbid urine containing no blood corpuscles or haemoglobin.

Five c.c. of blood were taken immediately from the heart of the above cow and injected subcutaneously into a healthy bull. The latter was kept under observation for 226 days but never showed any ill-effects or anaplasma-like bodies in its blood during the whole of that period.

The two other affected animals showed a few anaplasma-like bodies in their blood, invading from 2 to 3 per cent. of the corpuscles, but both contracted rinderpest after the removal from the quarantine shed and died from that disease.

Blood smears and tissue sections were stained with various modifications of the Romanowsky stain but the best pictures were obtained by the use of Giemsa following the technique recommended by SIEBER (moist fixation in sublimate alcohol and prolonged staining in a dilution of Giemsa solution in distilled water, differentiation in acetone xylol, and mounting in cedar wood oil). After the use of this method the bodies were easily distinguishable as they stained of a brilliant purplish red colour. They varied in size from 0·5 microns to 1·5 microns. They were situated as a rule towards the margin of the corpuscles, in some instances causing a bulging out of the margin. In cases where two bodies were present in one corpuscle it was often found that one was situated at the periphery while the other was placed more centrally; this seemed to indicate that frequently after division one of the newly formed bodies remains at or near its original location while the other migrates across to the other side of the corpuscle. In other cases both elements, however, remained close together at the periphery of the corpuscle. The newly formed bodies after division were frequently of equal size but it was often noted that one was much larger than the other, and in some cases where division was not complete this disproportion in size gave rise to appearances similar to the budding of yeast cells. The bodies stained uniformly and appeared to be composed of a mass of chromatin with no cellular substance; a slight halo was present around the majority of the bodies. They were more or less spherical in shape with a slightly uneven border.

The author quotes at some length THEILER's observations on the specificity of anaplasms. The above three cases were the only ones which came under Boynton's notice during a period of twenty months and thus he has been unable to perform any further work on the subject.

As these were the only cases encountered presenting pictures similar to those described by THEILER and SIEBER as anaplasma infection, it is doubtful whether the disease described by them really exists in the Philippine Islands or whether the animal suffered from some other affection which brought about the formation of the anaplasma-like bodies in the red corpuscles. Reference is made to the work of authors who have discovered anaplasma-like bodies in a great variety of other animals, and in some cases produced artificially by the injection of haemolytic substances (DIAS and ARAGAO).

GIBBINGS (G. H.) & STOCKMAN (Stewart). **The Treatment of English Redwater by Intravenous Injection of Tartar Emetic $[K(SbO)C_4H_4O_6]2H_2O$.**—*Jl. Comp. Path. & Therap.* 1917. Dec. Vol. 30. Pt. 4. pp. 316–320.

As the result of a few trials which, according to the authors, were possibly too few to justify a final conclusion, trypanblue did not appear to exert the same specific action on cases of English redwater due to *Piroplasma divergens* as it does in the case of tropical piroplasmosis. Moreover, this drug stains the milk and tissues for a considerable time, rendering the latter unmarketable. In experimenting at the laboratory with regard to the effect of various drugs on blood parasites when given intravenously Stockman found that tartar emetic in the dose of 1 gramme seemed to reduce the numbers of certain blood parasites of the Piroplasma class, and caused distorted forms to appear. Field experiments on the value of the treatment were carried out by Gibbings in Devonshire. It had been found at the laboratory that one to two grammes in 2 per cent. solution could be given in a single dose to an ox twelve months to two years old, and that one gramme doses were tolerated when given two or even three days in succession. It was not always possible to apply the treatment in the field at the early stage of the attack as the farmers in the district generally treated cases themselves with drenches of common salt, and did not call in veterinary help unless they were dissatisfied with the effect of this treatment.

The authors give details in tabular form of 84 cases treated with tartar emetic. Blood smears were not examined from all cases but it is considered that the parasite in practically all cases was almost certainly *P. divergens.* The tartar emetic was issued in a 2 per cent. solution in distilled water, 1 gramme dissolved in 50 c.c. constituting one dose. This was placed in sterile bottles, sterilised in the steamer, corked with sterile corks, and sealed. The injection was made into the jugular vein, care being taken that the liquid passed freely into the lumen of the vessel so as to avoid setting up phlebitis.

The table on following page is drawn up to give a brief summary of the results indicated in the authors' record of cases.

One animal that died would have lived according to the authors had it not been turned outdoors when very weak, and thus "omitting those slaughtered to save the carcase, in the above 84 cases there were 9 actual deaths (10·7 per cent.), which is a high mortality for English redwater, and is evidence that the type of disease prevailing was not mild during the time the drug was tested. Of the 9 fatal cases, 2 were treated with the drug on the first day symptoms were observed, and the other 7 fatalities occurred among animals which did not receive the drug before the third day of illness. It is also to be observed, however, that a number of animals recovered which were not treated with the drug before the third day."

Most of the cases that were injected on the first day had been treated by the owners with drenches of common salt. Four of the animals included among those that died were in a moribund condition when injected. The following cases are cited as examples of good recoveries:—

No. 20. Cow. Days ill when injected, 2. Remarks: Probably affected a couple of days before observed. Cow weak, and injected on ground; 24 hours after much improved, and following day urine clear.

No. 24. Cow. Days ill when injected, 4. Remarks: Had been drenched with common salt for 3 days in succession; urine very black and stained deeply; feeding a little; 5th day improved, and on 6th day urine clear. A very bad case.

No. 28. Cow (due to calve any minute). Days ill when injected, 5. Remarks: (1¼ doses) 1st. 2nd, and 3rd days had ¾ lb. common salt; 4th day nothing; 5th day injected, and 12 hours after there was slight improvement, then given 6 oz. common salt; 6th day urine much better, and cleared on 7th day. A very bad case.

Days ill when injected.	Urine clear within				Died	Destroyed.	Remarks.
	1 day.	2 days.	3 days.	4 days.			
1	19	17	1	—	2	7	Relapses occurred but subsequent recovery in 2 cases with clear urine in 2 days and 1 with clear urine in 3 days. In addition, recovery took place in 2 cases where time within which urine cleared is not stated.
2	5	6	1	—	—	1	2 cases. 1 with clear urine in 1 day and 1 with clear urine in 2 days, subsequently died.
3	6	4	—	—	7	—	1 case with clear urine in 1 day subsequently died. This is not included with the 7 under the heading "Died."
4	1	2	—	—	—	—	
5	—	1	—	1	—	—	
Not known.	—	—	—	—	1	—	

One case was peculiar in that the animal had a relapse three weeks after apparent recovery, and another case had a relapse four days after the urine had cleared. In one case it is noticeable that the animal became worse after injection but subsequently recovered. In the case of two animals it is stated that recovery would have taken place if they had received a second injection or drench. One animal was injected in the earliest stage when the urine was only just coloured and the urine deepened in colour until it died; it fed well for the first three days.

It is somewhat difficult for the reader to form an estimate as to the value of the treatment from the above remarks, but, as the authors state at the commencement of their article, "having regard to the fact that many cases of English redwater recover in the absence of treatment by drugs, it is not an easy matter to assign an accurate value to any form of treatment, even when very large numbers of cases have been examined in the clinical sense."

SCHEIN (Henri). **Piroplasmose du cheval dans le Sud Annam.** [Equine Piroplasmosis in South Annam, French Indo-China.]—*Bull. Soc. Path. Exot.* 1917. Dec. Vol. 10. No. 10. pp. 871–873. With 1 text-fig.

In 1901, 150 Poitou and Algerian mules employed for military purposes were transported to a certain station in a mountainous district. At first the animals kept in a very good condition, but after the onset of the rainy season deaths occurred until all the mules soon succumbed. The principal symptom was haemoglobinuria. The cause of the mortality could not be ascertained at the time. In 1910 a mare introduced into the same district developed haemoglobinuria and other symptoms of acute piroplasmosis and the presence of piroplasms was discovered in the blood. The native horse of this region appeared to be immune to the disease; the author made a search for piroplasms in a number of their bloods and found the parasites in one 18 year-old apparently healthy horse. The morphological characters of these parasites indicated that they belonged to the species *Nuttallia equi.* The author thus assumes that the extermination of the military transport animals in 1901 was due to this species of piroplasm.

VELU (H.). **Les affections du cheval à parasites endoglobulaires au Maroc.** [Equine Affections due to Intracorpuscular Parasites in Morocco.]—*Bull. Soc. Path. Exot.* 1918. Jan. Vol. 11. No. 1. pp. 26–27.

Equine piroplasmosis was first discovered in the Chaouia district in 1908 by LAFARGUE, LUSSAULT and SAVARY, and sporadic cases of the disease are now known to occur throughout Morocco. In this note Velu asserts that these cases comprise two distinct affections, one caused by *Piroplasma caballi*, and the other by *Nuttallia equi.* The symptoms of the so-called true piroplasmosis are described. One case of nuttalliasis came under the author's notice, and this is discussed at some length.

DI DOMIZIO (Giovanni). **Comportamento biologico del piroplasma bigeminum nei bovini della Colonia Eritrea.** [The Biological Characteristics of *P. bigeminum* in Bovines in Eritrea.]—*Moderno Zooiatro.* Pt. Sci. 1917. Oct. & Nov. Vol. 5. Nos. 10 & 11. pp. 232–236; 247–259. With 1 text-fig.

In this article the author gives an account of experience gained in the course of sero-vaccination against rinderpest in Eritrea, particularly with reference to the occurrence of redwater as a complication in that disease. According to him *P. bigeminum* is so widespread in Eritrea as to induce one to believe that all the cattle of the Colony become infected with the parasite at some period of their lifetime. The infection, however, remains latent and is not detectable clinically or microscopically, but is easily resuscitated simultaneously with the onset of symptoms of rinderpest, and to a less extent with other diseases. This phenomenon assumes considerable practical importance in connection with the use of virulent blood for rinderpest immunisation, inasmuch as the blood used may contain very numerous piroplasms intensified in virulence. The inoculation of such blood into animals of the Colony immune towards rinderpest has no untoward results, but is likely to cause much loss among susceptible animals.

The use of blood containing rinderpest virus in a state of purity would represent the ideal condition, but as this is impossible to obtain in Eritrea one should attempt to adopt methods for procuring virulent blood containing only traces of piroplasms, which are not demonstrable by repeated microscopic examination. It is thus recommended that virulent blood should be drawn on the 4th or 5th day after the onset of rinderpest symptoms, when the blood is most active and free from visible piroplasms. Virus should not be extracted from cattle during the period of diarrhoea, that is, on the 6th or 7th day of the disease, inasmuch as the virus then has become attenuated and the blood is more likely to contain large numbers of highly virulent piroplasms. Also care should be taken to allow the virus producers to contract the disease either spontaneously or by rubbing infective saliva on the buccal mucous membranes. Otherwise in the course of repeated transmission of the virus by inoculation one is likely to get a virus mixed with large numbers of piroplasms of exalted virulence.

LAVERAN (A.). **Identification des virus de trypanosomiase équine marocaine de deux origines.** [Identification of the Viruses of Equine Trypanosomiasis in Morocco obtained from Two Sources.]—*Bull. Soc. Path. Exot.* 1917. Nov. Vol. 10. No. 9. pp. 850–856.

VELU, Ed. SERGENT, LHÉRITIER and BELLEVAL studied in 1915 a trypanosomiasis of horses observed in different regions in Morocco, especially at Casablanca. The causal trypanosome was described by these authors as a new species under the name of *T. marocanum* [see this *Bulletin*, Vol. 3, p. 84, and Vol. 4, No. 1, pp. 2 and 8]. On the other hand C. FIORI, and M. and Mme. DELANOË observed a case of equine trypanosomiasis amongst some native cavalry at Mazagan [this *Bulletin*, Vol. 3, No. 3, pp. 85–86]. Laveran thought it would be of interest to find out whether the viruses from these two sources were of the same species and complete his work with reference to the identification of the Casablanca trypanosome.

A study of the morphology and pathogenicity of the above strains did not furnish any conclusive results. According to the original descriptions of FIORI and M. and Mme. DELANOË the Mazagan trypanosome was remarkably polymorphic; forms without free flagella were observed to a greater extent in the horse and especially in the rabbit than in the rat; in the rat a considerable number of trypanosomes without centrosomes were found and also the organisms attained larger dimensions in this animal than in the horse. The Casablanca trypanosome was on the other hand monomorphic. Unfortunately, after a few transmissions through laboratory animals the morphological anomalies shown by the Mazagan trypanosome disappeared, as often occurs in such cases, and one thus had to admit that these two strains could not be differentiated morphologically. More or less similar results were obtained by the inoculation of laboratory animals, but inasmuch as the same symptoms are often manifested in widely different trypanosomiases one could not infer from these results that both strains belonged to the same species. In these circumstances cross-immunity tests were indicated. Ed. SERGENT, LHÉRITIER and BELLEVAL had already commenced experiments in this connection and shown that animals that had acquired immunity against debab (according to Laveran the trypanosome of debab is a variety of *T. soudanense*) and an infection due to *T. soudanense* could be infected with the Casablanca trypanosome, and inversely, animals with an acquired immunity against the latter trypanosome could be infected with the debab trypanosome or with *T. equiperdum.* It was thus of interest to perform similar experiments with the Mazagan trypanosome, and to ascertain the relationship between the disease caused by this organism and some other trypanosomiases, viz., the infection due to *T. soudanense,* dourine, and also surra especially as one form of this disease—mbori—has been observed in different parts of Africa.

The cross immunity tests were performed on goats and full details of the experiments are given. The method briefly consisted in inoculating a goat with a small dose of one strain and after the disappearance of trypanosomes from the blood, as proved by the inoculation of susceptible animals, the goat was again given another dose of the same strain; no infection resulted as shown by inoculation of test animals thus showing that the goat had acquired an immunity towards this strain. The goat was then inoculated with the other strain and if infection subsequently took place the result indicated that the goat had become infected with trypanosomes of different species.

The following were briefly the results obtained :—

A goat which had acquired immunity against surra (Mauritius strain) proved to be susceptible towards the Mazagan trypanosome.

A goat which had acquired immunity towards the Mazagan trypanosome proved to be susceptible towards debab; the inverse was shown in another experiment.

Goats which had acquired immunity against surra, nagana, as well as infections produced by *T. rhodesiense* were shown to be susceptible towards the Casablanca trypanosome.

A goat which had acquired immunity against surra and the infections due to *T. soudanense* and its variety *T. berberum* was shown to be susceptible towards the Mazagan trypanosome. After it had become immune against the last-named organism inoculation with the Casablanca organism failed to infect.

The following are the author's conclusions :—

" (1) The Mazagan trypanosome cannot be identified with *T. evansi*, *T. soudanense* or *T. berberum.*

" (2) The Casablanca trypanosome cannot be identified with *T. evansi, T. brucei* or *T. berberum.*

"(3) The Mazagan trypanosome is apparently identical with the Casablanca trypanosome, or *T. marocanum* (SERGENT, LHÉRITIER, and BELLEVAL). The goat used in the last experiment had in fact acquired an immunity against several trypanosomes when it was inoculated unsuccessfully with *T. marocanum*, but only the Mazagan trypanosome could have conferred the immunity towards this last trypanosome."

MARTOGLIO (F.). **Su di un nuovo genere di parassiti del sangue.** [A New Genus of Blood Parasite.]—*Ann. d'Igiene.* 1917. Sept. 30. Vol. 27. No. 9. pp. 561–563. With 1 plate.

The above blood parasite was encountered by Martoglio in the course of transmission experiments with *Spiroschaudinnia marchouxi* Nuttall, 1904 or *Spirochaeta gallinarum* R. Blanchard, 1905, which causes considerable mortality among fowls in the highlands of Eritrea. A fowl inoculated with spirochaetes showed after 24 hours a few of these organisms in the circulating blood. On the second day they had increased in number and on the third day they were very abundant with a tendency to become agglutinated. On the fourth day they were present in the form of very numerous small clumps but on the following two days they could not be detected under the microscope. On the ninth day after infection blood examination revealed the presence of remarkable circular flagellated bodies which increased in number until three days afterwards when the animal succumbed. A few of these bodies were also found in smears from the internal organs.

In stained preparations the flagellate showed an alveolar protoplasmic body staining of a blue colour, circular or oval in shape, and from 8·5 to 10·5μ by 10·5 to 12μ in maximum diameter; sometimes a vacuole about 3μ in diameter could be seen. It possessed a trophonucleus, which assumed a distinct chromatinic tint and was usually oval and about 2·4 to 2·8μ by 3·2 to 4·8μ, disposed towards one side. There was also a kinetonucleus which sometimes stained less intensely and was elongated in form, 0·8 to 1·0μ broad by 1 to 1·6μ long and appeared to be always disposed towards the periphery of the organism; it generally presented two distinct chromatinic granules. The trophonucleus was separated from the kinetonucleus by a distance of 1μ or less. From the kinetonucleus there arose five flagella, four of which were free throughout their whole length or adhered in pairs for a small portion near their base, and these were from 10 to 15μ in length. The remaining one bordered a distinct undulating membrane with four or five convolutions which arose in the vicinity of the kinetonucleus, and terminated at the opposite pole so as to occupy about half the periphery of the parasite. At the line of attachment to the membrane the body appeared thickened in the form of a distinct rim. The flagellum bordering the undulating membrane then had a free portion about 10 to 12μ in length. Usually the kinetonucleus, trophonucleus and point of emergence of the free portion of the flagellum bordering the undulating membrane were on the median axis. From the two chromatinic granules of the kinetonucleus there arose two curved axostyles of a chromatinic tint which lay within the body of the parasite and were directed towards the opposite extremity, so as to enclose an elongated oval space containing the trophonucleus and become re-united at the other end of the protoplasmic body; in some cases they appeared to remain separated. Multiplication appeared to take place by longitudinal fission.

The pathogenic significance of this parasite could not be determined. Attempts at transmission gave negative results. A large percentage of deaths is often seen after the disappearance of the spirochaetes from the circulating blood of infected fowls.

From the above description the author states that the parasite possessed the characters of organisms of the Trichomonas type. He quotes references to such organisms described in cases of human dysentery and in the caeca of fowls. [He omits to refer to the occurrence of the very numerous Trichomonas in the lesions and intestinal contents of turkeys affected with the common disease known as "blackhead," as described by HADLEY (see this *Bulletin*, Vol. 5, No. 2, pp. 87–88) and JOWETT (1911) in South Africa. According to HADLEY the parasite originally described by Theobald SMITH as the cause of that disease and named by him *Amoeba meleagridis* was most probably identical with this organism. Martoglio probably encountered such parasites playing the role of secondary invaders in the circulating blood and originating from the intestine.—ED.]

On account of his discovery of the above organism in the circulating blood of the fowl the author proposes for it a new genus *Haemotrichomonas*. Organisms of this kind have already been described by PLIMMER in the circulating blood of snakes: these organisms would thus belong to the species *Haemotrichomonas ophidium* F. Martoglio 1917, while the fowl organism would be *H. gallinarum* F. Martoglio 1917.

SANLORENZO (Ferdinando). **Sulla diarrea rossa (Coccidiosi intestinale) dei bovini in Piemonte.** [Red Diarrhoea (Intestinal Coccidiosis) of Cattle in Piedmont.]—*Moderno Zooiatro.* Pt. Sci. 1917. Oct. & Nov. Vol. 5. Nos. 10 & 11. pp. 226–231; 241–247.

In this article the author gives an account of the literature dealing with the above disease together with a detailed account of the symptoms and lesions of a few cases observed by him in Northern Italy. He concludes from his observations that the disease is by no means rare among cattle in Italy and that thymol exerts a distinctly beneficial action in treatment.

RODHAIN (J.) & VAN DEN BRANDEN (F.). **Essais sur la pluralité des espèces flagellées parasitant le tube digestif des Invertébrés. Note préliminaire.** [Experiments on the Plurality of the Flagellate Species Parasitic in the Intestinal Tract of Invertebrates.]—*Bull. Soc. Path. Exot.* 1917. Nov. Vol. 10. No. 9. pp. 811–814.

The above authors have carried out some experiments since 1911 in the Lower Katanga district, Belgian Congo, with the object of ascertaining whether the cultural or developmental forms assumed by mammalian trypanosomes in the intestinal tract of Glossina can adapt themselves to the intestinal tract of non-blood-sucking insects capable of harbouring forms of animal life closely related to Crithidia.

The crithidial forms described by PATTON in the intestinal tract of a flesh-eating insect, *Gerris fossarum*, were found in 5 per cent. of the insects examined. This species of insect was systematically fed on *Glossina morsitans* caught on the park lands and infected to a considerable extent with *Trypanosoma congolense, T. pecaudi,* and *T. cazalboui*; none of the carnivorous insects became infected. The trypanosomide forms of *Glossina morsitans* are thus not adaptable to the intestinal tract of *Gerris fossarum.* Negative results were likewise obtained by feeding Asilus on Pycnosoma, Sarcophaga and Glossina.

In the experiments briefly described in this paper the authors attempted to infect (1) mosquitoes of the Stegomyia genus by feeding on Pycnosoma known to be infected with trypanosomides; (2) *Stegomyia fasciata* on infected *Glossina palpalis*; (3) fleas of the species *Cimex rotundatus* on Pycnosoma, and also (4) on *Glossina palpalis.* Negative results were obtained throughout.

The authors conclude from these various experiments that the flagellates parasitic in the intestinal tract of a given species of invertebrate do not appear to have the power of adapting themselves to the intestine of another species of invertebrate. The negative results obtained from the experiments tend to demonstrate the plurality of the flagellate species parasitic in the intestinal tract of invertebrates.

DISEASES DUE TO METAZOAN PARASITES.

Schwetz. **The Western and Northern Limit of *Glossina morsitans* in Northern Katanga.**—*Bull. Entom. Res.* 1917. Dec. Vol. 8. Pt. 2. pp. 165–168. With 1 map.

The Katanga district embraces a tract of territory in the southern portion of Belgian Congo abutting into Northern Rhodesia and drained by the streams which constitute the head waters of the Congo River. The distribution of the tsetse fly in the northern portion of this region has during the last three or four years formed the subject of investigations by the author. In a previous paper on the subject (1915) he asserted that *Glossina morsitans* inhabits only those parts where the vegetation is of a particular type, viz., bush or park-like country. On several journeys made in 1913 and 1914 between the River Lualaba and the River Lomami in the region between 9° and 6° S. Lat. he was able to define the spots where the park-like country and *Glossina morsitans* disappear almost simultaneously. These spots were described as the western limit of *morsitans.* He also drew attention to the fact that between 8° and 6° S. Lat. this double limit coincided with the line of the Lualaba-Lomami watershed. During 1916 several journeys were again made between the Lualaba and the Lomami and several more points were determined in the western limit of *morsitans,* and this time also the author was able to indicate the northern limit of the fly. Details are given with regard to the journeys undertaken together with the vegetation of the country traversed and the incidence of the tsetse fly. Particulars with regard to these journeys are represented on the map. The author thus summarises his observations:—

> "The hypothesis which I have previously suggested, that the limit of *morsitans* coincides more or less with that of the park (at least in Katanga), has just been confirmed by several new observations. But sometimes the

range of the fly terminates before the disappearance of the park. This double disappearance is *generally* gradual.

"Between 9° and 5° S. Lat. the western limits of the park and *G. morsitans* coincide roughly with the Lualaba-Lomami watershed, but most frequently they disappear a little to the east of this line, that is to say, they do not quite reach the Lomami basin.

"In this region, between the Lualaba and the Lomami, the park and *morsitans* gradually disappear in the neighbourhood of 5·30° S. Lat., that is, a little south of Kongolo."

SCHWETZ. **Preliminary Note on the Tsetse-Flies of the Kabalo-Albertville (Lualaba-Tanganyika) Railway.**—*Bull. Entom. Res.* 1917. Dec. Vol. 8. Pt. 2. pp. 169–175. With 1 map.

"The Kabalo-Albertville Railway is an important section of that great river and railroad route by which one can now cross the whole of equatorial Africa from Banana" (at the mouth of the Congo River) "to Daressalaam" (on the coast of German East Africa), "from the Atlantic Ocean to the Indian Ocean, without having to walk a single step. It is therefore a railway with a great future, which deserves to be studied from all points of view, and particularly with regard to the distribution of tsetse flies as the region traversed by this railway was ravaged a few years ago by sleeping sickness and the railway is probably destined in part for the transport of cattle."

Part of the route of this railway before construction was investigated by the author in 1911, and the present paper deals with a short study of the topography and the incidence of tsetse fly in the country now traversed by the railway at the beginning of 1916. The railway measures 273 kilometres, and a straight line drawn between the two termini would measure approximately 250 kilometres. From the point of view of the landscape in general and the vegetation in particular this distance is divisible into three sections :—(1) From Lualaba to the Luizi River, 63 kilometres; (2) from the Luizi River to the Niemba River, 174 km.; (3) from the Niemba River to the Lake, or Valley of Lukuga, 273 km.

The first section forms almost a straight line, and the ground is flat or slightly undulating; there is no stream in the neighbourhood of the railway. The country is wooded a few kilometres from Lualaba, but becomes gradually transformed into open, slightly wooded, meadow land a little before the Luizi. Tsetse flies are extremely numerous along this section and passengers are invariably bitten. The common species is *G. morsitans*, but two other species are known to exist here, viz., *pallidipes* and *brevipalpis*.

The second section presents different aspects in various parts but, briefly stated, it may be said to show a vegetation which is transitory between park and forest or an alternation of these two types of vegetation. The railway for some distance follows beside the stream from its source but in so doing it crosses or follows a band of forest. The study of the Glossina of this section is as complicated and difficult as that of the first section is simple and easy. Practically speaking, from the point of view of passengers, there are no tsetse in this section. However, the author was able to define certain small localities in which one or other of the following species could be found: *G. palpalis*, *brevipalpis*, and *pallidipes*; no *morsitans* was found.

The third section forms the most picturesque and interesting part of the journey, and runs alongside the River Lukuga. The valley of this river contains a park-like vegetation which has now undergone a good deal of artificial clearing in many places. During the present journey no *G. morsitans* was encountered although this fly, together with *G. palpalis* and *brevipalpis*, as discoverable in great numbers in 1911. The disappearance of *morsitans* from the railway itself has probably been caused by the gradual clearing. Some *brevipalpis* were found during the present journey, and the author is of opinion that at some distance from the railway *palpalis* and *morsitans* are also commonly found, but that all three species are so rare close to the railway itself that they need not seriously be reckoned with as regards passengers, either human or animal.

The author further argues that the scarcity of *morsitans* along the second section and its absence along the third section is really due to the species of vegetation prevalent and the clearing of the country and not, as is held by many, to the rarity of big game along these parts.

JACK (R. W.). **Tsetse Fly Investigations: Visit to Melsetter District and Portuguese East Africa.**—MS. Report forwarded to Colonial Office. 1918. Jan. 21. 11 pp. f'cap. With 1 map.

This report contains an account of a journey undertaken by the Government Entomologist of Southern Rhodesia to the Melsetter District of that territory and in Portuguese East Africa, commencing in August 1915, with the object of making investigations in connection with cases of trypanosomiasis amongst cattle which had occurred on several farms situated near the eastern border during the preceding seasons. The author summarises his observations as follows:—

"(1) A belt of tsetse fly, comprising two species, viz., *Glossina brevipalpis* Newst. and *G. pallidipes*, Aust. extends along the border in Portuguese Territory from about ten miles south of Spungabera to the Lusitu River and probably beyond. The belt is very lightly infested.

"(2) The cases of trypanosomiasis amongst cattle on farms in the Melsetter district are apparently due to an incursion of fly from this belt up the wooded river valleys during the summer months.

"(3) Infection could probably be avoided altogether by using the grazing in the eastern sides of the farms during the winter and moving the cattle to the western sides for the summer. The transference should be made before the advent of the rains.

"(4) There is no danger of an extensive invasion of this portion of the Melsetter district by tsetse.

"(5) The farms Bayswater, Farfell and possibly small portions of East Leigh and South Down might become permanent fly-belts later. Some miles of the Lusitu River within our borders might also be invaded, but owing to the scarcity of game. apart from bushbuck, along this well populated river, the suitability of conditions there is doubtful.

"(6) Fly has apparently been spreading slowly westward of late years and it is probable that the infestation of the country near our border will become intensified year by year if conditions remain as at present. The farmers on the farms affected are not likely therefore to be able to remit in future any measures adopted to avoid infection; more care is likely to be needed rather than the reverse.

"(7) The best protection against the fly would be the clearing of the forest from and in the neighbourhood of the affected farms.

"(8) There is no danger at present of an invasion of our territory by fly moving up the Sabi river valley."

ROUBAUD (E.). **Auto-inoculation et développement primaire, dans les muqueuses buccales, de la larve du Gastrophile équin (Œstre du cheval).** [Auto-Inoculation and Primary Development of the Horse Bot Larva.—*C. R. Acad. Sci.* 1917. Mar. 12. Vol. 164. No. 11. pp. 453–456.

The mode of entry of the larvae of the horse bot (*Gastrophilus intestinalis* De Geer) into the intestinal tract of their host and the primary conditions of their development are still unknown. According to certain authors (NUMAN, BRAUER) the young larvae after hatching out make their own way into the mouth and nostrils. The majority of writers, however, state that the larvae are introduced into the mouth by licking and then swallowed. The licking was attributed to the irritation set up by the presence of the small larvae on the skin.

Some Russian authors have set forth special theories on this subject based on the discovery of Gastrophilus larvae in cutaneous channels in a certain human myiasis. According to CHOLODKOVSKY the larvae after leaving the egg penetrate into the epidermis of the horse and set up an irritation which would cause the animal to bite the invaded tracts and extract the larvae from them. PORTCHINSKY, on the other hand, considers that only some of the larvae, which later die out, make their way into the epidermis; these fail to continue their development but the irritation set up by them would cause the horse to lick and collect with its tongue the other larvae which then pass into the digestive tract.

According to the author's observations the sequence of events occurs in a very different way. In the first place the eggs do not hatch out spontaneously and the primary larvae may remain within the egg in a state of latency for several weeks. Then the ripe egg liberates the larva by mechanical contact. Contact with the wet tongue is not indispensable; sudden friction against the lips or tongue fulfils the same purpose and it is well known that horses very rarely lick themselves. The primary larvae thus liberated and brought into contact with the mucous membrane of the lips or gums immediately force their way underneath the epithelium; in this position they can be seen through the transparent epithelial wall. The primary larvae unlike the larvae of Hypoderma are not capable of penetrating the skin whether dry or wet. They then make their way along through the mucous membrane of the mouth gradually increasing in size during their course. The author observed a larva for nine days on the edge of the tongue of a guinea-pig and at the end of this time it had increased three times in size and undergone a moult before entering the second stage.

EPIZOOTIC LYMPHANGITIS.

LANFRANCHI (A.). **L'Intrapalpebro-reazione nella diagnosi della linfangite epizootica.** [The Intra-Palpebral Reaction in the Diagnosis of Epizootic Lymphangitis.]—*Moderno Zooiatro.* 1917. Oct. 31. Vol. 5. No. 10. pp. 217–225. With 5 text-figs.

The diagnostic agent employed by the above author in a few cases consisted of an ethereal extract of cryptococcic pus. The pus was taken with sterile precautions from unopened abscesses, mixed with twice its volume of ether, shaken, and allowed to stand for 24 hours. The ether was then evaporated on a water bath and the solid residue made up again to the original bulk by the addition of distilled water, stirred from time to time, and allowed to stand for 24 hours. The mixture was then heated for 15–20 minutes at 80° C. and centrifuged. The overlying liquid constituted the diagnostic agent and was injected in doses varying from $2\frac{1}{2}$ to 3 c.c. according to the richness in cryptococci of the pus used.

In the case of healthy horses or those affected with glanders, strangles, botryomycosis, influenza and the common lymphangites the inoculation of the above liquid gave rise to an oedema which was limited to the seat of injection or at most spread only along the lower eyelid, and which began one or two hours after the inoculation and reached its maximum in about the 8th to the 10th hour, then became gradually re-absorbed and disappeared entirely in 20–24 hours. In the case of subjects affected with epizootic lymphangitis the local reaction began about the 2nd hour and by the 4th to the 6th hour spread along the whole of the lower eyelid, appreciably reducing in size the palpebral fissure. The oedema gradually increased and in from 20–24 hours reached downwards to the lower edge of the zygomatic crest and backwards to the angle of the jaw. This local reaction lasted for several hours and then gradually decreased in size but was quite appreciable even after three or four days. In addition to the swelling a marked degree of purulent conjunctivitis was set up. [The author does not say definitely whether the above material was tried in cases of sporothricosis. It would be interesting to know whether the same results could be obtained with extracts of common yeasts.—Ed.]

Velu (H.). i. **Nouvelles recherches sur la Pyothérapie de la Lymphangite épizootique.** [Further Researches on the Pyotherapy of Epizootic Lymphangitis.]—*Bull. Soc. Path. Exot.* 1917. Oct. Vol. 10. No. 8. pp. 681–684.

ii. **Au sujet des réactions locales dans le traitement de la lymphangite épizootique par la pyothérapie.** [Local Reactions in the Treatment of Epizootic Lymphangitis by means of Pyotherapy.]—*Bull. Soc. Cent. Méd. Vét.* 1917. Oct. 11. *Rec. Méd. Vét.* 1917. Oct. 30. Vol. 93. No. 20. pp. 380–381.

iii. **La pyothérapie de la lymphangite épizootique, telle qu'on la pratique au Maroc.** [The Pyotherapy of Epizootic Lymphangitis as practised in Morocco.]—*Bull. Soc. Cent. Méd. Vét.* 1917. Nov. 8. *Rec. Méd. Vét.* 1917. Nov. 30. Vol. 93. No. 22. pp. 452–456.

iv. **La pyothérapie dans le traitement des blessures de harnachement aux Colonies.** [Pyotherapy in the Treatment of Harness Wounds in the Colonies.]—*Bull. Soc. Path. Exot.* 1917. Dec. Vol. 10. No. 10. pp. 901–903.

v. **Au sujet de la préparation du pyovaccin contre la lymphangite épizootique.** [Preparation of the Pyovaccine for the Treatment of Epizootic Lymphangitis.]—*Ibid.* 1918. Jan. Vol. 11. No. 1. pp. 10–11.

vi. **Quelques considérations sur l'efficacité et la non spécificité absolue de la pyothérapie anticryptococcique chez le cheval.** [A Few Considerations on the Efficacity and the Absolute Non-Specificity of Anti-Cryptococcic Pyotherapy.]—*Ibid.* pp. 12–17.

An extract of a preliminary communication by the above author on the treatment of epizootic lymphangitis by means of the so-called "pyo-vaccine" has already been given recently in this *Bulletin* [see Vol. 5, No. 3, p. 186], and since then, as can be seen from the above titles, he has endeavoured to give very wide publicity to his methods.

The most recent method recommended for the manufacture of the vaccine is briefly as follows:—Pus is collected from the unopened abscesses of subjects affected with epizootic lymphangitis by means of a sterile syringe furnished with a wide bore. Also, in order to furnish a polyvalent vaccine capable of acting simultaneously on cryptococci and associated organisms in cases with complications, he recommends the collection of pus or serous fluid from the surface of open lesions or from the fissures in the crusts covering them. These products are placed immediately in a sterile flask containing a small quantity of ether and normal saline solution with ·5 per cent. carbolic acid and well shaken up. The proportions injected are pus, 1 part, ether, 1·5 parts, carbolised saline, 10 parts. If coagulation of the pus has taken place the clot is broken up by shaking with glass beads. The mixture is then filtered through from four to six layers of sterile gauze in order to eliminate coarse particles. The filtrate is then preserved in well stoppered flasks. Long continued exposure to high atmospheric temperatures does not seem to have a deleterious effect upon the vaccine.

The method of treatment as employed pretty generally now throughout Morocco is as follows:—The pyo-vaccine is administered intravenously; all recent cases of epizootic lymphangitis are amenable to treatment where no sinuses with dormant buds have yet formed. A dose of from 4 to 6 c.c. is given as a first injection. All lesions containing pus are immediately opened by means of a bold crucial incision extending into the healthy tissue and leaving behind no sinus. This is said to be a condition absolutely indispensable to recovery. The disease is first apparently aggravated with the formation of oedematous swellings around the swollen lymphatics and abscesses and an increase in suppuration and pain. This is the so-called negative phase, and is soon followed towards the 3rd or 4th day by marked improvement with decrease in size of the swellings, diminished suppuration, and lessening or even complete disappearance of pain; this is the so-called positive phase.

The second injection (1½ to 2½ c.c.) should be made towards the 8th or 10th day, sometimes the 12th, as soon as the positive phase or improvement in the symptoms begins to become less evident. The positive phase which follows the second injection is always very intense, and persistent, and when the injection is performed early it may be sufficient to bring about complete healing of the lesions by cicatrisation under scab without suppuration. In this case the treatment may be discontinued for a while.

The third injection is made in a dose of from ¾ to 1¼ c.c. at the time when cicatrisation appears to become rather slower, that is to say, towards the 8th, 12th, or sometimes the 13th day after the second injection.

The injections are repeated until recovery takes place in the same doses of $\frac{3}{4}$ to $1\frac{1}{4}$ c.c. as soon as a retardation of the positive phase appears, that is every five or eight days. In cases where the injections are followed by an intense and persistent negative phase it is advisable to defer further injections until the disease takes on its normal course and diminish the dose of the vaccine. Every time a new abscess or fistula appears it is opened boldly as soon as possible. Injections at weekly intervals are recommended in cases where the animals cannot be kept under regular supervision. Besides the bold incision of lesions, local treatment consists in the application of such products as antiseptic dusting powders, but the wounds should not be washed.

In his earlier experiments Velu employed subcutaneous injections of vaccine and these were followed either by more or less marked oedematous swellings or small collections of pus which became discharged by necrosis of the overlying skin. In spite of prolonged contact with ether and carbolised salt solution the cryptococci were found to have survived in some cases even for two months. The abscesses formed locally in the cases of epizootic lymphangitis so treated healed quickly after opening, but a few cases treated preventatively were followed by manifestations of the disease in other regions.

There appears to be no risk of setting up the disease by means of intravenous injections. A few cases are noted in which complete recovery took place in from 17 to 22 days after the commencement of the treatment.

The above method of treatment does not appear to be specific, inasmuch as striking recoveries appeared to take place after its employment in such suppurative conditions as long standing fistulae and arthritis. Velu quotes NICOLLE (Ch.) and BLAIZOT (L.), who noted similar properties in connection with their anti-staphylococcic vaccines prepared by treating the organisms with fluorides; also recoveries were stated to have been obtained by WRIGHT in cases where the disease had no relationship to the organism employed for vaccinating. The author concludes that para-specific polyvalent pyotherapy is a simple economic method which, judging from the results already obtained from it, should take a first place in veterinary therapeutics.

BRIDRÉ notes that results exactly comparable to those obtained by Velu can be observed after treatment with injections of strictly aseptic pus.

NICOLLE (Maurice), FAYET & TRUCHE. **Traitement de la lymphangite épizootique, au moyen du suc de levure autolysée.** [Treatment of Epizootic Lymphangitis by Means of Autolysed Yeast Extract.] *C. R. Acad. Sci.* 1917. Dec. 31. Vol. 165. No. 27. pp. 1114–1115.

The yeast extract is prepared by autolysing for 24 hours at 37° C. pressed yeast in chloroform vapour (M. NICOLLE and ADIL-BEY'S method). The material is then centrifuged and the overlying liquid filtered through a Chamberland F candle and carbolic acid added in the proportion of 0·5 per cent. The liquid is stored in sealed ampoules.

This material suggested itself for treatment on account of the close resemblance between Rivolta's cryptococcus and the common yeasts, and the method would thus constitute a so-called "group antigen-therapy." The authors give a short account of six advanced cases treated with injections of the above extract. Complete recoveries were obtained in from 40 to 50 days. In some cases marked local reactions were at first observed around the seat of injection together with fever and general depression. As the result of their experiments the authors recommend the injections to be carried out in the following way :—

Two c.c. are first injected under the skin of the neck in order to test the sensitiveness of the animal. After 4 to 8 days, according to the nature of the cases, the dose is raised to 5 c.c. ; in another 8 days 10 c.c. are injected ; one or two further injections of 10 c.c. each may be eventually made. The means of eliminating failures and shortening the duration of treatment are at present under study. The name "rivoltine" is proposed for the extract.

BRIDRÉ (J.). **Leucocytothérapie ou pyothérapie aseptique. Son emploi dans certaines lymphangites du cheval.** [Leucocyte-therapy or Aseptic Pyotherapy. Its Use in some Equine Lymphangites.]—*C. R. Acad. Sci.* 1917. Dec. 31. Vol. 165. No. 27. pp. 1121–1123.

Two French authors, BELIN and VELU (see above), have recently claimed to have treated cases of equine epizootic lymphangitis successfully by means of pyotherapy, that is, by means of injections of pus diluted in ether and carbolised salt solution. These authors hold that the method is analogous to WRIGHT's vaccine therapy but admit, however, that the treatment appears to furnish equally successful results in non-specific suppurative conditions such as ulcerative lymphangitis, chronic fistulous wounds, etc. BELIN also treated by this method cases of ulcerative lymphangitis using pus taken from the lesions of that disease. As, however, the causal organism (Preisz-Nocard bacillus) is often extremely scanty in the pus any success obtained could not be put down altogether to the action of the organisms.

Bridré endeavoured to ascertain whether the results obtained could not be attributed to the action of the leucocytes or their debris and thus treated a certain number of horses suffering from epizootic or ulcerative lymphangitis with aseptic pus. Each horse was injected under the skin of the breast with 1·5 c.c. of turpentine. After four or five days 6 c.c. of pus was taken from the abscess set up and mixed immediately with 24 c.c. normal salt solution, carbolised 0·5 per cent. This mixture was thoroughly shaken up and then diluted five times and injected subcutaneously in doses of 3 to 5 c.c. at intervals of 6 to 10 days. Marked improvement is stated to have been observed after the employment of the treatment in cases of both of the above diseases, although all local treatment was neglected.

LANFRANCHI (A.) & BARDELLI (P.). **La pioterapia nella Linfangite epizootica.** [Pyotherapy in the Treatment of Epizootic Lymphangitis.]—*Moderno Zooiatro* Pt. Sci. 1917. Dec. 31. Vol. 5. No. 12. pp. 261–275. With 9 text-figs.

In this article the above authors record a number of cases, 13 in all, of epizootic lymphangitis treated according to the methods recently described by BELIN and by VELU (see above).

The procedure as recommended by these authors is stated to have been rigorously carried out and a number of control animals similarly affected submitted to treatment by simple evacuation and washing of the abscesses. As the result of their experiments the authors emphatically declare against the use of so-called auto-pyotherapy. In no case did they observe the normal development of the disease arrested. They admit that the number of animals experimented upon was relatively small, but, on the other hand, the lines of treatment prescribed were carried out under the best conditions, and thus they conclude that the mode of treatment is not applicable to current practice.

BACTERIAL DISEASE.

PALAZZOLO (G.). **Nuove ricerche sull' eziologia e sulla trasmissione della peste de polmôes (infezione da ascessi) o mal dos polmôes (male degli ascessi).** [Further Researches on the Etiology and Transmission of *Peste dos Polmôes* (Abscess Plague) or *Mal dos Polmôes* (Abscess Disease).]—*Nuovo Ercolani.* 1917. Nov. 30. Vol. 22. No. 22. pp. 317–322. With 1 fig.

Outbreaks of the above disease cause great economic losses to cattle breeders in the States of Minas Gerâes and Paranà, Brazil.

It was first studied and described in 1912 by DIAZ (Ezequiel) and LEISBOA (Marques), who attributed it to infection with an organism of the Pasteurella group.

The disease was studied by the author on a ranch in the State of Paranà about 3,000 ft. above sea level, where the rains continue for about 120 days in the year. The daily temperature attained at certain periods 34° C. The clinical aspect of the disease is said to be typical. Young calves present a very repulsive appearance, the coat becomes ruffled, condition very weak and emaciated, and ulcerating abscesses and suppurating fistulae appear all over their bodies, which issue a very offensive odour. Numerous larvae of the "*varejeras*" fly are deposited on the ulcers. Febrile symptoms are rarely seen but diarrhoea of a haemorrhagic nature is almost invariably seen shortly before death, which usually occurs after about 12 days from the onset of symptoms from inanition.

In adult cattle the disease assumes a chronic form and in these cases one or more abscesses develop showing little tendency to ulceration and after six weeks or two months the animal usually completely recovers.

Pus taken from an unopened abscess on a naturally affected calf sown out aerobically and anaerobically on laboratory media gave rise to typical cultures of bi-polar organisms of the so-called Pasteurella group. Inoculation of broth cultures intraperitoneally into rabbits caused death in from 18 to 24 hours with abundant blood-stained exudate rich in bi-polar organisms in the serous sacs. Ten c.c. of this exudate was injected subcutaneously into a 20 days old calf. Two days afterwards there appeared at the seat of injection an abscess as large as a hen's egg and on the third day it discharged. The animal presented no marked rise in temperature but drank very little milk and was depressed, had a rough coat and muscular tremors. On the fifth day abscesses were noticed on the buttocks and the animal became still more weakly in condition. The superficial lymphatic glands were swollen, and a febrile rise of temperature was noted. On the sixth day the animal refused all food, the secondary abscesses discharged a yellowish blood-stained foetid pus, the breathing became dyspnoeic and the pulse weak and irregular. Finally blood-stained diarrhoea set in. On the seventh day the animal became semi-comatose, with temperature sub-normal, and died. On post-mortem examination an abundant blood-stained exudate was found in the peritoneal cavity, all the viscera were congested and the lymphatic glands were markedly swollen and hyperaemic. The intestinal mucous membrane was inflamed throughout. Bi-polar organisms were recovered by inoculation of heart blood on culture media.

The disease is generally believed to be more prevalent during the rainy season, but as cattle are usually herded together and the cows generally calve at that time the author attributes the increased number of outbreaks during that season to the bad hygienic conditions under which the animals live.

DISEASES DUE TO FILTERABLE VIRUSES.

(a) RABIES.

REMLINGER (P.) i. **Contribution à l'étude de la rage du cobaye.** [A Study of Rabies in the Guinea-Pig.]—*Ann. Inst. Pasteur.* 1917. Nov. Vol. 31. No. 11. pp. 537–570.

ii. **Comparaison de l'inoculation du virus rabique au lapin et au cobaye.** [Comparison between the Effects of Inoculating Rabies Virus into the Rabbit and Guinea-Pig.]—*C. R. Soc. Biol.* 1917. July 28. Vol. 80. No. 15. pp. 670–672.

iii. **Présence du virus dans la rate du cobaye rabique.** [The Presence of the Virus in the Spleen of the Rabid Guinea-Pig.]—*Ibid.* Oct. 20. No. 16. pp. 789–791.

iv. **Sur l'absorption du virus rabique par les muqueuses saines.** [The Absorption of the Rabies Virus by the Healthy Mucous Membranes.]—*Ibid.* Nov. 10. No. 17. pp. 815–817.

v. **Diffusion du virus rabique dans l'eau physiologique et le liquide de Locke.** [Diffusion of the Rabies Virus in Normal Saline Solution and in Locke's Fluid.]—*Ibid.* Nov. 24. No. 18. pp. 863–865.

vi. **Analogies expérimentales du tetanos et de la rage.** [Experimental Analogies between Tetanus and Rabies.]—*Ibid.* pp. 865–868.

vii. **Sur la présence du virus rabique dans les capsules surrénales.** [The Presence of the Rabies Virus in the Suprarenal Capsules.]—*Ibid.* Dec. 22. No. 20. pp. 951–952.

Extracts of two articles published by the above author on the peculiar symptomatology of rabies in the guinea-pig have already appeared in this *Bulletin* [see Vol. 5, No. 3, pp. 192–194]. The experimental data upon which his observations were based are detailed in the first article mentioned above and a summary of these observations together with those of the second and sixth on the above list are set forth in the conclusions to that article :—

"Whilst the fixed virus always produces the paralytic type of rabies in the guinea-pig the street virus on the other hand may set up a disease which may show a great variety of symptoms. The furious form is one of the most commonly observed forms, but all kinds lying intermediate between the most violent and, on the other hand, the most attenuated forms may be produced. Sometimes there is no agitation whatever the predominant symptom being dyspnoea and the symptoms might easily be mistaken for any of those of the numerous epizootic pulmonary affections of the guinea-pig. The dyspnoea even may be very slight and the disease then shows greater analogy with a septicaemia than a broncho-pneumonia.

"The spasmodic form which may be observed more especially after inoculations into the anterior chamber of the eye or nasal instillation is of a very special kind. It is essentially characterised by a violent reaction both objective and subjective (pruritus) at the seat of inoculation, pharyngeal gurglings and spasms, and convulsive crises. It shows great similarity with the most common forms of rabies in man.

"The course of rabies after its onset in the guinea-pig may be extremely short. Besides the above-mentioned forms which usually run their course in from 24 to 48 hours there is a fulminant form of such short duration that the disease may escape observation and death appears to take place suddenly. It follows that in experiments on rabies every guinea-pig which succumbs without showing any symptoms should be held as suspicious. Negri bodies should be looked for and the medulla sub-inoculated.

"Paralytic rabies shows itself as a flaccid form and as a contractile or pseudo-tetanic form. Both these forms may disclose an ascending course and bring about Landry's syndrome which is so frequently observed in the course of rabies symptoms.

"A certain number of factors may exercise an influence on the symptomatology of rabies. In the course of passages from guinea-pig to guinea-pig the street virus becomes more rapidly exalted than in the course of passages from rabbit to rabbit. After from 8 to 10 passages it invariably produces death in from 5 to 7 days. The first inoculations with virus from a dog may set up paralytic rabies. After 2 to 4 passages furious rabies is on the other hand observed in its most exalted form. The violence of the symptoms becomes afterwards attenuated and there are produced dysnoeic and pseudo-septicaemic forms which are then replaced towards the 20th passage by a paralytic form and this is afterwards the type invariably seen. The mode of inoculation and in the case of intra-muscular or subcutaneous injection the seat of inoculation, the age of the animal, the dose of virus injected, etc., have also a bearing on the symptoms observed. Whilst, in the case of intracranial or intraocular injections all the various forms of rabies may be noted, inoculations into the thigh muscles or into the plantar cushion of the foot set up almost exclusively the pseudo-tetanic form. The analogy between this picture and that of tetanus is made still more manifest by the fact that in the case of subcutaneous or intramuscular inoculation the paralysis almost always commences around the seat of inoculation.

"Paralytic rabies is observed more especially after inoculation with paralytic street viruses, in the case of young animals, and after the use of large doses of virus, whilst in the case of full-grown animals and with the use of very small doses there is a tendency for the furious form to be set up. In experimental guinea-pig rabies there is no splanchnic type comparable to the splanchnic type in tetanus.

"The guinea-pig is quite appreciably more susceptible to rabies than the rabbit; the period of incubation is shorter, and very minute or attenuated doses which fail to produce any effect on the rabbit set up the disease in the guinea-pig. These facts present a considerable advantage which, however, only in part counterbalance the brief duration of the disease and its variability from the clinical point of view. This must not be lost sight of in the case of investigations on rabies."

iii. BABES appears to have been the only investigator who succeeded in transmitting rabies by spleen inoculation and he was led to believe that the spleen sometimes contained the virus, inasmuch as inflammatory and sometimes necrotic nodules could be observed in the spleens of men and other animals found dead of rabies. In Remlinger's experiments positive results were obtained in three out of 12 young guinea-pigs inoculated sub-durally and into the neck muscles with emulsions of the spleen of guinea-pigs that had died from 1–12 hours previously from rabies. Inasmuch as these results might have been produced by the post-mortem diffusion of the virus he further inoculated 12 guinea-pigs from the spleens of rabid guinea-pigs which were killed a few hours before death should have taken place, and in this experiment also positive results were obtained in three cases In a third series of experiments 12 guinea-pigs which had succumbed to inoculation with the street virus were left for 24–48 hours at laboratory temperature and the spleens were then inoculated into the muscles of the neck of susceptible guinea-pigs ; one animal only out of 12 developed the disease. Similarly, out of 6 guinea-pigs inoculated in the same way with three rabid spleens each 1 only developed rabies. This would indicate that the presence of the virus in the spleen is not due to a post-mortem generalisation.

iv. In 1903 Remlinger succeeded in transmitting rabies in 7 cases out of 12 by instillation of fixed virus on the pituitary mucous membrane of the rabbit, and these results confirmed those previously obtained by GALTIER and COMTE. More recently FERMI (1907) using a Sardinian virus adapted to rats obtained positive results in the case of the rat (all positive) and also with the rabbit and guinea-pig (a few failures). REPETTO (1909) using this same virus arrived at a similar conclusion (3 positive results out of 5 in the case of the rat). On the other hand GALBIATI (1906) and GARCIA Y IZCARA (1905) obtained negative results only. The latter author observed that animals became affected with rabies in cases where the mucous membrane was very slightly injured and thus believed that the injury caused by foreign bodies might constitute a port of entry through the mucous membrane and give rise to errors. In his experiments Remlinger carefully avoided this source of error and out of 30 animals inoculated in the series described 11 contracted the disease. Although young guinea-pigs seemed to be more susceptible than adults the absorption of the virus through the pituitary mucous membrane appeared to be less dependent upon the state of the membrane than on the adaptation of the virus to the species of animal injected with it. Thus in the case of the rabbit the fixed virus gives a high percentage of positive results and in the case of the guinea-pig the number of positive results increases with the number of passages through the guinea-pig the virus used has been subjected to.

In 1903 the author obtained negative results only after the instillation of fixed virus into the conjunctival sac of the rabbit ; positive results, however, had been recorded by GALTIER and COMTE. More recently NICHOLAS (1904) obtained positive results in 12 cases out of 57. A fresh series of experiments undertaken on the guinea-pig with a virus adapted for this animal by means of numerous passages also furnished negative results only. These negative results are in agreement with those obtained by GARCIA Y IZCARA, GALBIATI, and FERMI. Instillations of virus on to the mucous membrane of the vagina, penis, and anus, as in FERMI's experiments, likewise gave negative results only. The pituitary mucous membrane thus appears to be the only surface permeable to rabies infection.

v. BÜJWID (1905) showed that if healthy calf brain is placed in contact with rabies brain and kept in the dark in an atmosphere free from oxygen the normal brain becomes infective for the rabbit a few days later. NITSCH (1905) also showed that if a rabid rabbit brain is placed in distilled water or normal saline solution in an atmosphere free from oxygen the virus passes after 24 hours into the liquid.

Remlinger placed the washed brains of guinea-pigs which had succumbed to the fixed or street virus in sterilised Ringer-Locke fluid in the incubator at 37° C. for from 1–4 days. Out of 30 guinea-pigs inoculated into the neck muscles with doses of from 2 to 3 c.c. of the fluid three died of septicaemia due to contamination, 20 remained healthy, and 7 became definitely affected with rabies. The above results could not have been due to growth of the virus inasmuch as similar results were obtained after the injection of salt solution placed in contact with rabid brains and kept in an ice chest or at room temperature. It is stated that this could not have been due to putrefaction for after the immersion of the brain in various oils in which putrefaction could also take place negative results only followed inoculation of the surrounding liquid. Further after the prevention of putrefaction by immersion in glycerine the surrounding liquid was found to be more virulent than when Ringer's fluid was employed.

vii. The supra-renal capsules in animals dead from rabies have been shown to be virulent by some observers. POOR obtained positive results in one case out of every two. Inasmuch as these results have been criticised by some authors on account of the fact that not sufficient care was taken to avoid the possibility of post-mortem generalisation the author performed two series of experiments. In one of these 16 guinea-pigs were inoculated in various ways with street virus and killed several hours before death apparently would have taken place. Emulsions of the capsules in saline solution inoculated into the neck muscles of guinea-pigs gave positive results in 7 cases out of 16. In the second series 16 guinea-pigs similarly inoculated with street virus were kept at room temperature for from 24–48 hours after death. Emulsions of the capsules then inoculated into guinea-pigs gave positive results in 11 out of 16 cases. It is thus concluded that the supra-renal capsules are often virulent in the course of rabies and that the virulence is not necessarily due to post-mortem generalisation.

NICOLLE (Charles). **De l'emploi du cobaye comme animal réactif pour le diagnostic expérimental de la rage des rues.** [The Use of the Guinea-Pig for Experimental Diagnosis of Street Rabies.]—*C. R. Soc. Biol.* 1917. Oct. 20. Vol. 80. No. 16. pp. 788–789.

From motives of economy the guinea-pig has been employed since July 1916 at the Pasteur Institute, Tunis, for the above purpose instead of the rabbit. The diagnosis is made by inoculation of one drop of emulsion from the nervous centres of the suspected animal into one eye; the material had usually been forwarded in glycerine. In practice the new method was found to give as good results as when rabbits were employed. During the year 1915–1916 rabbits only were employed, 68 inoculations were made with 32 positive results, 31 negative, and 5 doubtful. During the year 1916–1917 the guinea-pig was substituted for the rabbit; 83 inoculations were made with 41 positive results, 23 negative, and 19 doubtful. Whilst the employment of the guinea-pig was more economical it had a disadvantage in that furious rabies is of commoner occurrence than in the case of the rabbit. No accidents, however, occurred. It is stated that street rabies in the guinea-pig shows an infinitely greater variety of symptoms than in the rabbit. This has been discussed in detail by REMLINGER [see above].

BURMEISTER (W. H.). **Effect of the Injection of Nonspecific Foreign Substances on the Course of Experimental Rabies.**—*Jl. Infect. Dis.* 1917. July. Vol. 21. No. 1. pp. 95–107. With 5 tables.

" Investigations on the treatment of infectious diseases have recently received additional stimuli as a result of many favourable reports on the effect of nonspecific biochemic therapy in some of these diseases. Principal among the latter are rheumatic arthritis, gonorrheal arthritis, and typhoid fever. Experimentally, it has long been known that the resistance of animals to some infections could occasionally be raised by the injection of heterogeneous nonspecific substances. Thus Pfeiffer found that by injecting broth intraperitoneally the resistance of guinea-pigs to cholera infection was materially raised. Thus, also Babes, Fermi, and Repetto claimed to have produced immunity to rabies by subsequent treatments with normal brain tissue. Fermi claims, furthermore, to have rendered animals immune to experimental rabies by injections of fresh egg-yolk, mixtures of cholesterin and lecithin, and other lipoidal substances. The work of Babes, Fermi and Repetto have, however, not met with universal confirmation by other investigators. The objection most frequently raised to this work has been that the rabies inoculations were made subcutaneously. Their protocols present recoveries in 50–66 per cent. in relatively large series of animals. According to Koch, however, inoculations subcutaneously of rabies virus result in positive takes in only about 50 per cent. of the animals inoculated, whereas subdural or intracerebral inoculations are positive in 100 per cent. Repetto contends, however, that the percentage of positive infections in the subcutaneous inoculation of the virus in rats is greater than this, and that the results not in accord with his were obtained by others who did not repeat all the conditions of his experiments. The control series of Fermi's experiments show a high mortality. He frequently worked with an equal number of animals in the control series, and the death rate from rabies invariably was 100 per cent. His findings, that nonspecific therapy in his street virus experiments resulted in a greater number of cures than did specific treatment administered according to the routine method of Pasteur, are almost paradoxical. If legitimate criticism is to be avoided in future experimental therapeutic investigations of rabies, all animals should receive their virus inoculations subdurally or intracerebrally. True, such inoculations are most radical and do not at all resemble the manner in which man or animals usually become infected. However, unless a therapeutic measure can be discovered which will withstand the most rigid conditions, it would scarcely seem advisable to substitute it clinically for the practically universal Pasteur method of treatment."

The author then proceeds to describe a series of experiments in which 63 rabbits were inoculated in all, 17 serving as controls. These rabbits were injected subdurally with from 3 to 5 times the minimum lethal dose of virus and certain animals were then treated by intravenous injection of horse serum, egg-white, egg-yolk, broth culture media, globulin of horse serum (both anti-tetanic and anti-diphtheria serum being used), typhoid vaccine, or tuberculin. The maximum dose of these substances compatible with the physical condition of the animal was used. A few of the animals succumbed to attacks resembling acute anaphylaxis. The following conclusions are drawn up by the author as the result of these experiments :—

"The injection of certain nonspecific substances (horse serum, serum globulin, egg-white, egg-yolk, broth, typhoid vaccine, or tuberculin) does not inhibit the course of experimental rabies in rabbits produced by non-attenuated virus. The seemingly beneficial effect of tuberculin in the early series of the experiments must be disregarded because of the survival of some control animals inoculated at a later date with the same virus.

"The results of Fermi and Repetto cannot be obtained with egg-yolk injections when potent rabies virus is inoculated subdurally or intracerebrally in rabbits.

"Rabbits surviving an intracerebral inoculation of attenuated rabies virus (fixed or street virus), may become hypersensitive to a reinoculation of the same virus made in the same way."

KOYANO (Tadayasu). **Über das Verhalten der Blutkorperchen der experimentell (durch das fixe Virus) an Tollwut erkrankten Kaninchen.** [The Composition of the Blood Corpuscles in Rabbits Experimentally Inoculated with Rabies (Fixed Virus).]—*Mitteil. a. d. Med. Fak. d. Kais. Univ. zu Tokyo.* 1917. Mar. Vol. 17. No. 1. pp. 69–85. With 6 tables & 8 figs.

In this article the author describes experiments in which a dozen rabbits were inoculated subdurally with the fixed rabies virus and the corpuscular contents of the blood were subsequently carefully estimated daily up to the time of death. The corpuscles of each rabbit were also counted before inoculation; the relative proportions of the various corpuscles according to numerous authors are also indicated. The following are the author's conclusions :—

"(1) The fixed rabies virus has no noteworthy action upon the red corpuscles of the rabbit.

"(2) In some cases no leucocytosis is caused by the fixed virus in the rabbit and in other cases only a slight degree of leucocytosis.

"(3) This leucocytosis is independent of the increase in body temperature in experimental rabies.

"(4) Polynuclear pseudo-eosinophiles constitute the majority of the white corpuscles in the rabid rabbit, especially in the course of the paralytic symptoms, whilst, on the other hand lymphocytes predominate in the normal blood of the rabbit.

"This increase in the polynuclears can be observed to a high degree first of all a few days after the subdural inoculation and then it sinks down to its normal level and rises again markedly for the second time with the onset of paralysis; this is characteristic of rabies as Courmont has already indicated.

"(5) The onset of paralysis is always accompanied by a marked increase in the young forms of the polynuclears, myelocytes, metamyelocytes and *stabkernigen.* No myeloblasts can be observed at this stage.

"(6) The eosinophiles gradually decrease in number after the inoculation.

"(7) The mast cells increase in number for a few days (at most three days) after the subdural inoculation, but this is not characteristic of rabies as it was also seen in control animals.

"(8) The large mononuclears and transition forms show no noteworthy changes.

"(9) The small lymphocytes which are about the same size or smaller than the red corpuscles decrease suddenly with the onset of paralytic symptoms. On the other hand they may be observed to increase during the first hour or for a few days after the subdural inoculation as in the case of mast cells, but this is not specific for the fixed virus as it was also seen after inoculation with normal non-rabid brain substance.

"(10) From the above data one may infer that the fixed virus has a stimulating action upon the bone marrow so that certain changes are brought about in the blood composition and apparently some effect is also produced upon the lymphatic system. Although this effect is not pronounced during the incubation period it becomes suddenly manifest with the onset of symptoms.

"This conclusion thus lends considerable support to the probability of the presence of a rabies toxin in the blood and lymph stream especially with the onset of symptoms."

(b) RINDERPEST.

SHILSTON (A. W.). **The Vitality of the Rinderpest Virus outside the Animal Body under Natural Conditions.**—*Agric. Res. Inst. Pusa. Memoirs of the Department of Agriculture in India.* Veterinary Series. 1917. Oct. Vol. 3. No. 1. 32 pp. With 4 plates. Calcutta: Thacker, Spink & Co. [Price As. 12 or 1*s.*].

"Although rinderpest has been the subject of extensive investigations in many countries, great uncertainty has existed with regard to the length of time the virus is able to survive outside the animal body either under natural conditions or when special measures are taken to preserve its vitality. The question of the duration of rinderpest infection, apart from affected animals is, however, of great importance in relation to the control of the disease in the field, and the observations recorded in this memoir were carried out with a view to obtaining exact information on this point under varying conditions in India."

A long list of references to the literature of the disease is given to indicate the extent to which the views of various authorities differ.

In order that the tests might be as complete as possible they were carried out by the author both at the Muktesar laboratory, 7,500 ft. above sea level and, with the exception of the tests of meat, blood, and bones, at Bareilly under "plains" conditions. The experiments in each case are described separately.

(I) *Duration of Rinderpest Infection on Ground in the Open.*

"(a) Observations at Muktesar. Several authorities who state their opinion that rinderpest infection may persist, under certain conditions, for long periods refer to the rapidity with which the virus is destroyed by exposure to sunlight.

"To determine therefore to what extent the duration of ground infection was influenced by direct sunlight, two small wire enclosures were constructed, one without any protection against the sun and the other almost entirely shaded by overhanging trees.

"For the purpose of infecting the enclosures, two "Hill" bulls suffering from acute rinderpest, with vesicles in the mouth and diarrhoea, were turned into each and allowed to remain until in a dying condition. They were then removed and at varying intervals healthy "Hill" bulls were placed in the enclosures to test the existence of infection. Each test animal was kept in the enclosure at least 24 hours, usually longer, and was afterwards disinfected and segregated with healthy "Hill" bulls to control the possibility of subsequent outside infection.

"In the case of those animals which contracted the disease, the diagnosis was confirmed by post-mortem examination or blood inoculation. The susceptibility of all animals which failed to react was subsequently tested by the inoculation of virulent blood or, in a few cases, exposure to infection in later experiments.

"During the period covered by the tests all varieties of weather conditions were experienced except great cold. The daily maximum shade temperature varied from 63° to 82° F. and the minimum from 47° to 62° F.

. . . . . .

"(b) Observations at Bareilly.—Tests similar to those described above were repeated at Bareilly. Two enclosures, one fully exposed and the other well shaded, were employed as before.

"Throughout the experiments the weather was clear and bright with a maximum shade temperature varying from 100° F. when the observations were commenced, to about 75° F. at their close: the daily minimum temperature varied from 70° to 45° F. during the observations."

The author gives brief and concise details of these experiments.

In the following table a summary of these experiments is given.

Number of Experiment.	Intervals after removal of the sick animals at which infectiveness was tested.	Result.
	1. *Ground exposed to direct sunlight.*	
	(a) *At Muktesar.*	
1	1 and 2 days	Infection absent.
2	16 and 20 hours	,, ,,
3	16, 20, and 24 hours ..	,, ,,
4	12, 24, and 30 hours ..	,, ,,
5	5, 8, and 20 hours	,, ,,
6	5, 8, and 20 hours	Infection present after 5 and 8 hours but not after 20 hours.
7	5, 8, and 20 hours	Infection absent.
	(b) *At Bareilly.*	
1	8, 20, and 32 hours.. ..	Infection absent.
2	6, 12, and 24 hours.. ..	Infection present after 6 hours but not after 12 and 24 hours.
3	4, 8, and 20 hours	Infection present after 4 hours but not after 8 and 20 hours.
	2. *Ground shaded by trees.*	
	(a) *At Muktesar.*	
1	2, 3, and 4 days	Infection absent.
2	44, 56, and 72 hours ..	,, ,,
3	32, 48, and 56 hours ..	,, ,,
4	6, 18, 30, and 48 hours ..	Infection present after 6 hours but not after 18, 30, and 48 hours.
5	6, 18, 30, and 48 hours ..	Infection present after 6 and 18 hours but not after 30 and 48 hours.
	(b) *At Bareilly.*	
1	8, 20, and 32 hours.. ..	Infection absent.
2	8, 20, and 32 hours.. ..	Infection present after 20 hours but not after 32 hours.
3	8, 24, and 48 hours.. ..	Infection present after 24 hours but not after 48 hours.

"Conclusions.—(1) In the hills open ground free from vegetation and exposed to direct sunlight, when heavily infected by animals suffering from rinderpest, was found to be infective for healthy cattle eight hours after removal of the sick animals but not for a longer period. In the plains under similar conditions infection did not persist for more than six hours.

"(2) When protection from direct sunlight was provided the rinderpest virus was found to survive on the ground in the hills for 18 hours and in the plains for 24 hours but not for longer periods. In some of the experiments infection was absent after similar or shorter intervals of time."

(II) *Duration of Rinderpest Infection in Closed Sheds.*

(a) Observations at Muktesar.—"In order that the conditions under which the tests were carried out might be as variable as possible, two sheds were utilised. One was a well built masonry stable with slate and cement floor and the other a rough wattle-and-mud erection with thatched roof and plain earth floor, the latter being the common type of cattle shed found in the hill districts.

Number of Experiment.	Intervals after removal of sick animals at which infectiveness was tested.	Result.
	(a) *In stone stable at Muktesar.*	
1	4, 5, and 6 days	Infection not present.
2	32, 56, and 80 hours ..	" " "
3	24, 48, and 72 hours ..	" " "
4	6, 18, and 30 hours	Infection present after 6 and 18 hours but absent after 30 hours.
	(b) *In wattle-and-mud shed at Muktesar.*	
1	2, 4, and 6 days	Infection present after 2 days but absent after 4 or 6 days.
2	3, 4, and 5 days	Infection not present.
3	24, 48, and 57 hours ..	Infection present after 24 and 48 hours but absent after 57 hours.
	(c) *In open stables at Bareilly.*	
1	12, 24, and 48 hours ..	Infection not present.
2	12, 24, and 48 hours ..	Infection present after 12 hours but absent after 24 and 48 hours.
3	12, 24, and 48 hours ..	Infection present after 12 hours but absent after 24 and 48 hours.
4	8, 20, and 44 hours	Infection present after 8 hours but absent after 20 and 44 hours.
5	8, 20, and 32 hours	Infection present after 8 and 20 hours but absent after 32 hours.
6	8, 20, and 32 hours	Infection present after 8 and 20 hours but absent after 32 hours.

"Hill bulls suffering from rinderpest were placed in the sheds to infect them and were left there until a short time before death; no litter was taken from the sheds during an observation. At intervals after the removal of the sick animals healthy Hill bulls were turned into the sheds and left for at least 24 hours to test whether the rinderpest virus was still capable of causing infection. Later the test animals were isolated in company with healthy bulls to control the possibility of outside infection. The susceptibility of all animals failing to react was subsequently tested by an injection of virulent blood or successful exposure to natural infection in later experiments.

"*Post-mortem* examinations and, if necessary, blood inoculations, were carried out in the case of all animals which died without having shown diagnostic symptoms during life.

"During the observations the daily maximum shade temperature varied from 56° to 73° F. and the minimum from 37° to 57° F.

. . . .

"(b) Observations at Bareilly.—For these tests two stables of similar construction were employed. Each was built of brick, closed on three sides but open on the fourth, with tiled roof and earth floor. The tests were carried out as in previous experiments. The variation in shade temperatures were the same as noted under the tests of ground infection"

The table on page 27 gives a summary of the results obtained.

"Conclusions.—(1) In the hills, rinderpest infection was found to persist in a stone stable with slate floor for 18 hours after removal of the sick animals, but not for longer periods.

"(2) In a wattle-and-mud shed with earth floor and no windows, in the same situation, rinderpest infection persisted for 48 hours after removal of the sick animals, but not for longer periods.

"(3) In the plains, open stables were found to be infective up to 20 hours after removal of the sick animals, but not for longer periods."

(III) *Duration of Vitality of the Rinderpest Virus in Faeces, Urine and Mucus Discharges.*

"In the foregoing observations the method of testing the presence of rinderpest infection by placing healthy animals on the infected areas, although simulating natural conditions most closely, does not allow of precise conclusions being drawn as to the vitality of the virus owing to the possibilities of accidental avoidance of the infected material by the test animals. The following experiments were therefore carried out to test more accurately the length of time that the virus can maintain its vitality in faeces, urine, and mucus discharges from animals suffering from rinderpest.

"(a) Observations made at Muktesar.—The material was collected from sick animals at the height of an attack and kept at room temperature in open vessels. At intervals portions of it mixed with a small quantity of meal were fed to healthy cattle. Owing to failure to produce infection in the first two experiments by this method of administration some of the material was also rubbed into the nostrils and on the muffle of the test animals in the subsequent observations.

. . . .

"(b) Observations made at Bareilly.—As the purpose of the tests with discharges from sick animals was to control the observations ca ried out in the enclosures and various buildings under more natural conditions, the procedure followed at Bareilly was to collect and mix the material and divide it into two portions; one half was then stored in the shade at air temperature and the other exposed to direct sunlight in the open. At intervals the infectiveness of each portion was tested on healthy hill bulls as in the experiments at Muktesar.

"The daily maximum shade temperature varied from 82° to 95° F. and the minimum from 58° to 68° F., during the observations."

The above experiments are summarised in the following Table :—

(a) *Observations at Muktesar.*

No. of Experiment.	Material.	Intervals after collection at which infectiveness was tested.	Result.
1	Faeces	48 and 72 hours	Not infective.
	Urine	,, ,,	
2	Faeces	36 and 48 hours	
	Urine	24 and 33 hours	
3	Faeces	28 and 44 hours	Infective after both intervals.
	Saliva and nasal discharge.	,, ,,	Infective after both intervals.
4	Faeces	29, 48, and 54 hours	Infective after all intervals.
	Saliva and nasal discharge.	,, ,,	Infective after 29 hours, but not after 48 and 54 hours.
5	Faeces, saliva and nasal discharge mixed	48, 66, and 78 hours	Not infective.
	Faeces	30, 48, and 72 hours	Infective after 30 and 48 hours, but not after 72 hours.

(b) *Observations at Bareilly.*

No. of Experiment.	Conditions under which mixed faeces and urine were kept.	Intervals after collection at which infectiveness was tested.	Result.
1	In shade	12, 24, and 48 hours	Not infected.
	In sun	6, 12, and 36 hours	Infective after 6 hours, but not after 12 and 36 hours.
2	In shade	,, ,, ,,	Infective after all intervals.
	In sun	,, ,, ,,	Infective after 6 hours, but not after 12 or 36 hours.
3	In shade	8, 24, 48, and 72 hours	Infective after 8 and 24 hours, but not after 48 and 72 hours.
	In sun	8, 24, and 48 hours	Infective after 8 hours, but not after 24 and 48 hours.

"Conclusions.—(1) At Muktesar faeces and urine collected from animals suffering from rinderpest during the later stages of the disease and stored in the shade at air temperatures varying from 54° to 73° F. remained infective to healthy animals up to 54 hours after collection, but frequently these materials become non-infective after shorter intervals. In the plains at slightly higher temperatures, faeces and urine were found to be non-infective beyond 36 hours.

"These observations confirm the results obtained by exposure of healthy cattle in sheds, and in enclosures shaded by trees at intervals after the removal of sick animals.

"(2) When exposed to direct sunlight the virus survived in mixed faeces and urine for 8 hours but not for 12 hours; in the same materials kept in the shade the virus survived for 36 hours. The results obtained in infected enclosures, without shade, are therefore confirmed.

"(3) The rinderpest virus survived in mixed saliva and nasal discharge kept at room temperature for 44 hours. It appeared to be less resistant in these discharges than in faeces and urine, since in one observation the infectiveness of saliva and nasal discharge was lost 48 hours after collection although faeces and urine from the same animal remained infective for 54 hours."

(IV) *The Length of Time after the Death of the Animal that Rinderpest Virus can survive in Meat, Blood, and Bone Marrow under Natural Conditions.*

"In addition to the excreta and mucus discharges of sick animals, the carcases of those that have died from rinderpest have also to be taken into consideration as possible sources of infection to others, especially as such carcases are commonly left to be broken up and carried away by birds and beasts of prey; it is important, therefore, to know how long the rinderpest virus can survive in the animal tissues after death.

"A large number of observations have recently been made on the preservation of the rinderpest virus in a virulent condition in connection with the immunisation of Government cattle by the serum simultaneous method, but only those carried out with material stored under natural conditions will be recorded in the present report.

"All the tests were carried out at the Muktesar Laboratory. Blood for these observations was usually taken from a hill bull in the last stages of an attack of rinderpest and about 500 c.c. kept in an open dish at room temperature without protection of any kind; its infectiveness was tested at intervals by injecting 1 c.c. subcutaneously into a healthy hill bull.

"Meat and bones were removed as soon as an animal in the last stages of the disease had been bled to death, and both were left exposed at room temperature. The meat was cut from the hind quarters in pieces of about 6 to 8 lb. weight; the survival of the rinderpest virus was tested by cutting out a small piece from the depth of the tissue, crushing it in a mortar with a few cubic centimetres of normal saline solution and injecting the fluid into a healthy hill bull.

"The infectiveness of the bones was tested by sawing one of these open, removing the marrow and mixing it with normal saline solution; the fluid, filtered through muslin, was then injected subcutaneously into a healthy hill bull."

The author then gives details of these experiments including the variation in temperature during the period of the experiments and the condition of the material in each case at the time of administration.

The following table gives a summary of the results obtained :—

Experiment.	Hill bull.	Material taken.	Intervals of exposure at air temperature after which tested.	Result.
1	7108	Blood . .	3 and 6 days .	Not infective.
		Meat . .	3, 6 and 10 days .	Infective after 3 days but not after 6 and 10 days.
2	7192	Blood . .	2, 3, 4 and 9 days .	Infective after all intervals.
		Bone marrow	5 and 9 days .	Infective after both intervals.
		Meat . .	3, 5 and 9 days .	Infective after 3 and 5 days ; test animal injected with 9 days old meat found to be immune.
3	7257	Blood . .	2, 3, 4, 5, 7 and 9 days . . .	Infective at all intervals up to 7 days, but not infective after 9 days.
4	7273	Bone marrow	3, 6, 9 and 15 days	Infective after 3 and 9 days, not infective after 15 days. Test animal injected with 6 days old marrow found to be immune.
5	7338	Blood . .	3, 5, 7 and 9 days .	Infective at all intervals.
6	7590	Blood . .	3, 6, 9, 12, 15, 16, 21, 24, 27, 30, 33, 36, 39, 42, 45, 48, 51, 57, 63, 69, 75 and 81 days . .	Infective at all intervals up to 51 days, but not infective after 57 days.

" Conclusions.—(1) The length of time that the rinderpest virus is able to survive in blood from a sick animal kept at air temperature in an open vessel varies within wide limits ; in one observation such blood was non-infective after 3 days' exposure, while in another it remained infective for 51 days although putrefaction set in after a few days' exposure and by the 30th day the blood was completely desiccated. In two other observations blood was still infective after 9 days' exposure to the air and in a third it was infective after 7 days' but non-infective after 9 days' exposure.

" (2) In two observations the virus maintained its vitality in bone marrow for 9 days, but in one of these cases infectiveness was lost after 15 days.

" (3) Meat was infective after 3 days in one observation when blood from the same animal was non-infective within that period ; in another case meat remained infective for 5 days.

" (4) Further tests are necessary to determine the factors influencing the survival of the rinderpest virus in animal tissues under natural conditions ; the temperature at which the material is kept appears to have a considerable effect, possibly in determining the rate and character of the putrefactive changes taking place, but it has been shown that these may not destroy the virus as rapidly as many authorities have stated to be the case."

SCHEIN (H.). **Etudes sur la Peste Bovine.** [Studies on Rinderpest.]—*Ann. Inst. Pasteur.* 1917. Nov. Vol. 31. No. 11. pp. 571–592.

Whereas satisfactory results have been obtained in the case of oxen by the simultaneous injection of serum and virus this procedure applied to buffaloes in the hands of the author and his colleagues has led only to disastrous results, causing a mortality in certain herds of up to 60 per cent. Acting upon the advice of ROUX the author has carried out investigations during the last few years in order to ascertain whether an immunity could be obtained by the use of sensitised viruses prepared in the same manner as described by BESREDKA for human typhoid fever and BRIDRÉ for sheep pox. The use of mixtures of serum and virus was tried by KOLLE without success as far back as 1898 when, however, little knowledge existed regarding the phenomena of sensitisation. REFIK Bey, a pupil of M. NICOLLE, apparently obtained satisfactory results by the use of this method, but unfortunately they were not published.

Schein's experiments, carried out in French Indo-China, were performed on goats, the supply of calves having become exhausted. The goat appears to constitute an excellent animal for maintaining the virus. The effects of inoculation are somewhat irregular during the first few passages, but in the course of further sub-inoculations it seems to become accustomed to the new host. At present the inoculated animals die rapidly without exception; the first fifty passages of the virus gave 87 deaths out of 100 animals, each inoculated with ½ c.c. of virulent blood. In another series of passages four animals survived out of the first twelve animals inoculated with ½ c.c. each, while only one survived out of the following twelve successively infected. The activity of the virus does not appear to be affected in the course of a large number of passages through the goat; virus taken at the 59th and 169th passages produced a reaction and subsequent recovery in inoculated calves, but a calf infected with virus after 172 passages died.

Almost all authors admit that the rinderpest virus is to be found within the corpuscles of the blood. BOYNTON, however, claimed that the red corpuscles or leucocytes used separately failed to set up the disease. The author, however, states that he was led to the same conclusions as KOLLE on repeating that author's original experiments, viz. (1) after the clotting of virulent blood the serum has lost its virulence; (2) the deposit of corpuscles obtained by centrifugation of defibrinated blood remains virulent; (3) corpuscles obtained by centrifugation of citrated blood are virulent; the plasma obtained in this way also remains virulent, thus differing from the serum, but it appears to be far less active than the corpuscles. Seven c.c. of plasma gave rise to a fatal infection, 1 c.c. produced only a strong reaction followed by immunity, while $\frac{1}{10}$th c.c. and smaller quantities gave negative results.

The serum obtained from hyper-immunised cattle exhibited no haemolytic action on goat corpuscles, even when added in large proportions (2 of serum to 1 of corpuscles) for 24 hours.

The author failed to discover any means of preserving the virus. Washed defibrinated corpuscles incorporated in a solution of gelatin and kept for 15 days in an ice chest had lost their infectivity. Bone marrow, which was claimed by LINGARD to retain the virus for a long period, failed to infect after storage in the ice chest for one month.

In the course of the author's experiments on sensitisation he endeavoured to determine approximately the quantity of infective material contained in 1 c.c. of blood, taken in every case on the 7th day after infection. One c.c. of 1–1,000 dilution of whole or defibrinated blood was found to be always virulent and thus the author employs this dose in maintaining the virus by sub-inoculations in the laboratory. To test the efficacy of this small quantity as compared with larger doses a series of sub-inoculations were made. The first 12 goats received $\frac{1}{2}$ c.c. each of undiluted blood; all died except 4, the 6th to the 9th inclusive. The following 11 animals each received successively 1 c.c. of 1–1,000 dilution; all died except 4, the 5th and the 9th to the 11th, inclusive. The following 12 then received $\frac{1}{2}$ c.c. each of undiluted blood; all died except 1, the 7th. The following 12 each received a dose of the 1–1,000 dilution; all died except the 8th. 0·001 c.c. thus appears to be quite as virulent as 0·5 c.c.

A number of experiments were made with weaker dilutions of whole blood diluted with saline solution immediately after bleeding, the dose given being 1 c.c. in each case. The limit of infectivity was reached by the employment of 1–25,000 dilutions; 8 animals were thus inoculated; 4 reacted, out of which 3 died. Dilutions of 1–50,000 and 1–100,000 failed to infect. Vaccination by means of successively smaller dilutions was found to be unreliable, as already shown by M. NICOLLE. It is thus calculated that as 1–25,000 appears to be the limit of infective dilutions there would be about 25,000 organisms or groups of organisms in 1 c.c., or 25 in one cubic millimetre. If the virus is situated in the white corpuscles there would thus be only one affected leucocyte out of every 320, and this would explain BOYNTON's failure to reproduce the disease by the inoculation of only one or two white corpuscles.

The comparative virulence of the red and the white corpuscles was next studied and a method for obtaining these elements in an approximately pure condition by centrifugation is described. It was found that the deposit of pure red corpuscles was never virulent in dilutions of 1–5,000 whereas the whole blood was constantly infective in 1–10,000 dilutions. The white corpuscles, however, proved to be infective in one out of three trials in dilutions of 1–50,000 or probably higher. This would appear to confirm M. NICOLLE's opinion that the virus is to be found chiefly within the leucocytes.

Plasma obtained from centrifuged oxalated blood produced fatal results in two cases in doses of 1 c.c.; out of three animals inoculated with $\frac{1}{10}$th c.c. one died, one reacted, and one remained unaffected; out of 6 inoculated with $\frac{1}{20}$th c.c. 2 died and 4 were unaffected and remained susceptible; with $\frac{1}{30}$th c.c. 2 animals died and 1 was vaccinated. It is stated that there would thus be probably about 20 organisms in 1 c.c. of plasma, that a single organism is capable of producing death in susceptible animals, and that the rare cases of vaccination obtained by the use of dilutions of blood or plasma must be attributed to the individual resistance of the inoculated animals.

In a series of experiments on the action of specific anti-sera on the rinderpest virus *in vivo* using the goat as test animal the following were briefly the results obtained:—Ox anti-rinderpest serum, injected simultaneously with 1 c.c. of virulent blood, appeared to have an appreciable protective action but this did not seem to be very great, constant, or durable. Buffalo anti-rinderpest serum was similarly tested in 4 cases, and death resulted in each case. It would thus appear that serum from immune buffaloes is very poor in anti-bodies. Goat anti-serum seemed to be more active than ox serum, given in doses of 5 c.c. The dose of serum injected cannot be diminished relatively to the quantity of virus given; thus out of 5 animals inoculated with 1 c.c. of goat anti-serum two survived and became immune although they had been inoculated at the same time with ½ c.c. of virulent blood; on the other hand the other three received very weak dilutions—two 1–4,000 and the third 1–1,000—and died. The serum must thus owe its preventive action not to its effect upon the infective material, but to the strengthening of the defensive powers of the body. These results did not enable the author to hold forth much hope from the results of sensitisation. It is stated that *a priori*, however, it would appear advantageous to produce infection by inoculating very much smaller doses of virus, viz., $\frac{1}{1000}$th c.c. of blood.

With regard to the action of non-specific substances on the virus it was found that normal saline solution produced no appreciable effect but in some cases normal ox serum seemed capable of attenuating or destroying the goat virus. Normal goat serum had no action on the goat virus.

A number of experiments were then made to ascertain the action of specific ox and goat sera, heated and unheated, on virulent blood or washed corpuscles when mixed together in various proportions. The results obtained after inoculation of such mixtures were very contradictory and did not furnish any definite evidence of sensitisation. Taking into consideration the action of normal ox serum the effects produced could be assigned to the very low resistance of the virus outside the animal body.

Having in mind the experience obtained with regard to the dilution of virus and effects of serum as applied to goats, the author proceeded to apply it to a number of outbreaks of rinderpest occurring in six villages in French Indo-China. These outbreaks were all of a subacute nature. In one village where the disease was allowed to run its course there were 71 oxen, 17 became infected and 5 died, and out of 145 buffaloes 57 became affected, with 23 deaths. The method of vaccination employed was as follows:—Cattle received each from 40 to 80 c.c. of serum according to size and age and buffaloes from 100 to 160 c.c. (i.e., 50 c.c. per 1,000 kilos. for adults and double that quantity for the young more susceptible animals). All inoculated animals were injected with 1 c.c. of a 1–1,000 dilution of virulent blood. This was obtained by withdrawing a couple of c.c. from the jugular vein of an affected animal and placing 1 c.c. in a litre of sterile saline solution (common salt 8 grammes, sodium oxalate 2 grammes). This was shaken up from time to time to prevent deposition of the corpuscles and dilutions were made from freshly drawn blood twice a day. Out of 557 oxen inoculated 117 became infected and none died. Out of 477 buffaloes inoculated 128 became infected and 14 died. In three of the villages virus taken from naturally affected animals was employed and it is noticeable that the mortality in these cases was markedly lower than in the other villages where the laboratory virus was used.

ANGELOFF (St.). **Auftreten und Bekämpfung der Rinderpest im Königreich Bulgarien während des Balkankrieges 1912-1913.** [Rinderpest in Bulgaria during the 1912–1913 Balkan War.]—*Arch. f. Wiss. u. Prakt. Tierheilk.* 1917. Nov. Vol. 43. No. 6. pp. 383–420. With 7 text-figs. & 10 charts.

In the past rinderpest has nearly always gained access to the Balkan Peninsula from Asiatic Turkey, where the disease is enzootic. This is known to have taken place in the case of the outbreaks of 1853 and 1863 which caused great losses among cattle in the neighbourhood of Tschataldja. During the war of independence in 1877–1878 rinderpest was introduced by means of either Russian or Turkish transports into what were then the Eastern Provinces of Turkey in Europe, and after the war it spread throughout the newly formed Principality of Bulgaria and with especial severity in its Southern Provinces. Owing to the measures taken by the new Government the disease was brought under control and eradicated. Almost two-thirds of the cattle of Bulgaria were lost in this epizootic. Five years later, that is, in 1883, rinderpest was introduced into the town of Varna on the Black Sea coast, by means of cattle brought from Russia for breeding purposes. By enforcing slaughter of all affected and in-contact animals in the surrounding district where the disease had broken out the epizootic was soon eradicated. By means of measures introduced for the regulation of exportation and importation of stock and animal products the country remained free of the disease from that time until recently, although in the meantime it had appeared in Turkey in Europe and in 1906 it was observed close to the frontier. During the war against Turkey from 1912 up to its end in 1913 rinderpest did not appear to have left its centres in Asia Minor; at least, it was never observed in Thrace. However, during the second part of the war when Bulgaria was attacked (!) by her former allies Serbia and Greece and also by Roumania the Turks took the opportunity of re-occupying that part of Thrace which had been taken from them and their troops crossed from over the Maritza into Bulgaria. As all the cattle in Thrace had been slaughtered and taken away during the war the Turks brought for provisioning and transport cattle which could only be obtained from Asia. With these cattle they also brought rinderpest; it is well known that the disease was introduced into Thrace with the 4th Erzerum Division in July 1913, and in a short time spread throughout the whole of the territory re-occupied by the Turks, and thence fugitives from Thrace brought it with their cattle over the frontier into the south-eastern districts of Old Bulgaria and over the Maritza up to Grimildjina on the Aegean Coast. Owing to the movements of fugitives in all directions the outbreak assumed a very widespread character and caused great losses until a number of veterinarians were released from the Army to deal with it; the losses then rapidly diminished. In the four districts affected in South-Eastern Bulgaria the losses amounted to 4,555 head of cattle, of which 2,856 died from the disease and 1,339 were slaughtered. This would correspond with a mortality rate of 62 per cent. up to the time of slaughter. The first cases were reported towards the end of October 1913, and the disease was definitely diagnosed by the author in November 1913 in the neighbourhood of Adrianople among transport oxen, which had been employed by peasants for carrying booty left by the Turks as far forward as Gallipoli and had become infected on the return journey.

The author then gives a very clear account of the clinical and post-mortem appearances manifested by affected animals during the outbreak. The course of the disease was for the most part acute; the symptoms were at their height in from 4 to 6 days; hyper-acute and sub-acute cases were seldom observed. On the other hand cases running an abortive course were often observed, especially among the native grey breed; the affected animals showed no visible symptoms beyond a high temperature or slight loss of condition for a couple of days. Buffaloes were usually more resistant than cattle and generally the disease ran in them a milder course. The infection had much less tendency to spread than in the case of the other contagious diseases of the country, viz., foot-and-mouth disease and sheep-pox. All the cattle in one shed did not become affected when they were separated a short distance from one another. In one town with a Turkish population the disease remained for five months uncontrolled but only 510 out of 771 cattle became affected, or 66 per cent. According to the author's observations the susceptibility of the Bulgarian grey breed is much less than that of other European breeds. In the neighbourhood of Burgas Swiss and Dutch cattle were kept in sheds; all the cattle became infected and the mortality rose to 95 per cent. while the average mortality among native cattle was 62 per cent.

Exanthematous lesions on the skin were only observed in two cases out of several hundred examined. The author gives indications for the differential diagnosis of the disease from the conditions with which it is most likely to be confused in Bulgaria, viz., haemorrhagic-septicaemia, foot-and-mouth disease, piroplasmosis, and acute gastro-enteritis.

During the course of his work at the temporary rinderpest serum station at Lidjaken near Burgas Angeloff carried out a series of very interesting short investigations. A careful microscopic examination of the tissues and fluids of affected animals as to the presence of a causal micro-organism led to no result. Cultural experiments likewise proved negative. Precipitin and deviation of the complement tests were carried out, using extracts of various organs as antigen. No precipitation was observed and in all the experiments with sera from affected or hyper-immune animals there was either no deviation of complement or no more than when sera from normal animals were employed.

Some experiments on the resistance of the rinderpest virus were performed and gave results somewhat contradictory to those of the earlier observers. The part played by the importation of hides from affected animals in the spread of rinderpest is of great importance and special precautions had always been taken in dealing with the importation of such hides from Asia and Egypt, but a danger always existed owing to the smuggling of fresh hides into the country from Turkey. The durability of the virus was ascertained by placing together skins from animals slaughtered at the height of an attack with common salt in the proportion of 1 in 10. A decoction of large pieces, scrapings of sections, and thin slices of the skins thus treated were fed five days after separation from the dead animal to two susceptible animals, after ten days to another two, and after 15 days to another one. None of these animals became infected. Two susceptible animals likewise fed with products from a hide taken 40 days previously from an affected animal but stored in a dry shaded place and not salted remained unaffected.

Defibrinated virulent blood mixed with salt in proportion of 1 to 10 and stored in the dark at room temperature was injected after 48 hours in a dose of 10 cc. into a susceptible animal with negative result, while cattle injected after 48 hours with the same quantity of blood that had not been treated in this way reacted rather strongly. The untreated blood of affected animals kept in the dark at room temperature in vessels plugged with cotton wool usually lost its virulence after four to five days.

A small experiment showed that the virus is soon destroyed by putrefaction outside the animal body. Two susceptible young cattle were placed in a stall which had contained eight days previously a severely affected rinderpest animal and had not since been cleaned out. Both remained apparently healthy and the temperature normal for a month but they succumbed later after they had been injected with virulent blood.

In order to determine whether the incubation period was longer than the average in the case of the native breeds the daily temperatures of such animals used for virus production was taken and it was found that out of 37 cattle injected with from 1 to 50 c.c. virulent blood subcutaneously the shortest period was three days, and the longest 17 days; most of the animals had an incubation period of from four to six days.

The question whether rinderpest was communicable to sheep, goats and swine was of great importance inasmuch as these animals lived together with cattle in many places and might thus act as media for the spread of the disease, and also secondly it might be possible in this way to obtain an animal for the transportation of blood for the simultaneous inoculation which would be moreover free of cattle piroplasms. A sheep, a goat, and a pig were thus each inoculated subcutaneously with 1 c.c. of virulent blood. The temperature was taken twice daily and the general condition noted. Five days after the inoculation the sheep and goat showed a rise of temperature and in the course of the next six days loss of appetite, coughing, and discharge from the eyes and nose. Diarrhoea also set in finally in the case of the sheep. The disease ran a much milder course in the goat than in the sheep. Seven days after the appearance of symptoms both animals were slaughtered for post-mortem examination. This revealed congestion of the mucous membrane of the fourth stomach and intestine together with haemorrhages in some places. In the case of the sheep the changes were more marked than in the goat; there were small erosions on the buccal mucous membrane, and the mucous membrane of the respiratory tract was much redder than in the case of the goat. Diphtheritic changes were not observable. The other organs showed scarcely any changes. The pig showed no rise in temperature or change in condition after the injection. This result corresponds with those obtained by THEILER in South Africa after inoculation of virulent blood into pigs. [See, however, BOYNTON's experiments, this *Bulletin*, Vol. 5. No. 1. p. 48.—ED.]

During the course of the outbreaks of rinderpest no cases of the naturally contracted disease were observed among sheep or goats although these animals were often placed together in the same sheds as infected cattle.

Some experiments on the value of gall inoculation were performed at one naturally affected centre and at the serum station. In the affected centre the draught and milch cattle were kept in yards while the other cattle were isolated a considerable distance away in a wood. 32 cattle which had not become affected in one yard were inoculated with gall taken from an animal at the height of an attack, the dose being 10 c.c. for adults, 5 c.c. for young animals and 3 c.c. for sucking calves. None of these animals became subsequently affected. The 92 animals isolated in the wood were similarly inoculated and of these five became affected and died after inoculation. These results appeared to be very good but it was decided to test the method on a number of animals used for furnishing virulent blood at the serum station. From these experiments it was concluded (1) that gall inoculation gave no specially good results in the case of the native grey breed; (2) the inoculated animals were subsequently liable to become affected with rinderpest contracted as the result of artificial infection or spontaneously as when placed among affected animals; (3) the animals given a protective inoculation with gall became affected with a mild form of the disease and the mortality was distinctly lower—9·09 per cent.—in the author's cases. There appeared to be no relationship between the severity of the symptoms and the quantity of virulent blood injected. As a result of these experiments gall inoculation was abandoned in practice and serum prepared for the eradication of the disease.

A very few experiments were made to ascertain the curative effects of drenching with creolin, the infusion of large quantities of normal saline solution, and serum. One rather severely affected animal recovered after receiving drenches of creolin, and another recovered after inoculation with hypertonic salt solution.

In choosing a site for the serum station a small island in the Black Sea was first selected, but, owing to the absence of a water supply, the station had to be removed to the mainland near the coast. Details are given with regard to the personnel and equipment of the laboratory. In order to obtain a supply of serum rapidly the author first of all endeavoured to obtain animals which had withstood the disease in affected centres. These were rather difficult to get as all suspected animals had been slaughtered. However, eight such animals were obtained in order to commence immunisation. In order to establish a ground immunity these animals were first injected with 10 c.c. of gall and 10 to 15 days later 1 to 100 c.c. of virulent blood. Later when serum was obtainable the animals were first inoculated with 10 to 45 c.c. of serum and 1 to 100 c.c. of virulent blood. The animals were further hyper-immunised according to either the rapid or slow method.

(a) Rapid method. In about 14 or 15 days each animal received from 1 to 5 litres of virus. After 12 to 14 days the first bleeding of 4 litres was taken, after another 5 days a second bleeding and after another 5 days a third bleeding of 4 litres each. After three weeks interval the animals were again given 1 to 7 litres of virus and 12 days later bleeding was repeated.

(b) Slow method. The animals were given 100 to 500 c.c. of virus, then at intervals of from 10 to 14 days three successive injections of 2 to 5 litres of virus in increasing quantities and 12 days after the last injection bleeding took place.

For the most part the rapid method was employed and after the establishment of a ground immunity up to 8 litres of virus were injected followed by bleeding after 12 days. The virus was given subcutaneously in most cases and sometimes intravenously.

Very full and clear details are given with regard to the manipulation of the animals used in the production of serum and the methods employed in the laboratory for getting the serum ready for issue. The total quantity of serum produced was 557,685 litres and by means of this product and the application of veterinary police measures rinderpest was eradicated.

Inoculation by the "serum alone" method was employed without exception. At the beginning only from 25 to 50 c.c. of serum, according to size of the animal, was inoculated subcutaneously, but later when more serum was available up to 100 c.c. was injected. Altogether 5,216 animals were treated with serum out of which 47 subsequently became affected (0·9 per cent.). Most of the latter, however, were affected soon after the injection, that is to say, during the incubation period. It was proved by experiments that the serum administered in doses of 40 c.c. conveyed a passive immunity which lasted about one month. The serum appeared to exercise a distinctly curative effect when administered in large doses intravenously into an affected animal.

With regard to the institution of veterinary police measures the active assistance of the military authorities was obtained in order to detect and control affected centres. Immediately the disease was diagnosed in a certain place a diseased zone was declared at a radius of 20 kilometres from the centre and a Commission, including a veterinarian, set up for the control of the disease in each zone. In the affected centres all movement of men, animals, and farm products was forbidden and at first slaughter of all infected and suspected in-contact cattle was ordered. Later when serum was obtainable only the affected animals were slaughtered and those showing high temperatures; all the others were inoculated with serum. The carcases of all dead or slaughtered animals were buried 6 feet deep without cutting the skin. With the approval of the Commission the flesh of suspected animals could be eaten by the inhabitants of the affected centres only. The hides of such animals were utilised after disinfection in lime water and drying. Rinderpest was declared to have been eradicated in a centre 40 days after the appearance of the last suspected case and after thorough disinfection with lime water, creolin, or carbolic acid. The dung was either burnt or covered with earth and lime. Every assistance was given by the peasants in carrying out these orders.

In order to guard against the introduction of rinderpest from Turkey a protective zone 30 kilometres deep has been set up. The cattle in these zones are under the control of veterinary officers and a register is kept of all oxen and buffaloes in the possession of the inhabitants and thus all movements and changes in the cattle population are recorded; all suspected diseases of cattle are immediately examined by subordinate veterinary officers. These measures enabled Bulgaria to eradicate and exclude rinderpest in the time of peace but it is greatly feared that a calamity might occur again under war conditions, and more especially owing to the state of anarchy at present existing in Russia, whence rinderpest may spread most easily towards the west. [It is undoubtedly this danger to the cattle population of the Central Powers which has recently led to such prominence being given in their veterinary literature to rinderpest.—ED.].

FERRARO (Giuseppe). **Perchè persiste la peste bovina in Eritrea.** [Why Rinderpest persists in Eritrea.]—*Moderno Zooiatro.* 1917. Sept. 30. Vol. 5. No. 9. pp. 215–216.

In this open letter to ZONCHELLO (A.), whose observations on rinderpest in the above Italian Colony have already been referred to in this *Bulletin* [see Vol. 5, No. 2, pp. 127], Ferraro repeats the statement already published by him in 1912, viz., that the persistence of rinderpest in that country is essentially due to the so-called " simultaneous " method of inoculation adopted by the authorities in dealing with outbreaks. Rinderpest was imported into Eritrea in 1887–1888 and almost immediately afterwards caudal inoculation was practised as a method of vaccination. However, the disease neither spread very much nor was it of long duration, and during the Italian campaign in 1895–1896 it remained circumscribed in the Agrodat District. It reappeared in 1897 along the sea coast and owing to a repetition of the above inoculations the epizootic assumed a wide-spread character. In 1900 to 1901, before the Bloemfontein Conference had taken place, CONTI had already tried the KOLLE and TURNER method at Asmara.

According to the author ZONCHELLO was able to demonstrate that rinderpest could be eradicated from the country simply by the application of vigorous quarantine restrictions to affected centres; 142 centres originating from vaccinations performed at Naro-Carora were stamped out in this way. The great epizootic of cattle plague in South Africa is now commonly held to have originated from Eritrea.

The author further indicates that although the authorities might be excused for the adoption of vaccination methods during the conduct of military operations, there is no justification for their continuance during the present settled state of the Colony in view of the very good results obtained by ZONCHELLO.

(c) SHEEP-POX.

MANNINGER (R.). **Ueber Komplementbindungsversuche bei Schafpocken.** [Complement Tests in Sheep-pox.]—*Cent. f. Bakt.* 1. Abt. Orig. 1917. Nov. 15. Vol. 80. No. 4. pp. 190–195. With 3 tables.

In the case of human small-pox the majority of workers have found that the blood serum of affected subjects possesses complement-binding substances when placed in contact with small-pox material. However, it was noted that the antigen differed greatly according to its origin, for while the serum and various organs of affected human subjects only in rare cases furnished appreciable antigen the crusts and pustule contents of the skin lesions almost always gave positive results. Complement binding has also been obtained by several authors after the use of calf lymph as antigen but some other workers assert that lymph is of no use as antigen. KLEIN (1914) states that this can be accounted for by the fact that sufficient virus is not present in every lymph.

In the case of cow pox JOBLING (1906) and also SHIGA (1910) showed that the serum of vaccinated calves contained amboceptors when placed in contact with fresh extract of pustules. On the other hand HELLER and TOMARKIN (1907) could observe no binding of the complement in similar circumstances.

In this article the author describes experiments performed in order to determine the existence of complement-binding amboceptors in the sera of sheep artificially inoculated with sheep-pox, and sheep suffering from the naturally contracted disease. Preliminary experiments showed that the best materials for furnishing antigen were emulsions of the crusts, formed by the desiccation of the exuding lymph on the surface of incised pustules, or of the crushed up pustules. Emulsions of infected pustules and of skin seldom contained appreciable antigen. In his further tests the crusts of dried lymph were invariably employed and these were obtained as follows. A sheep was inoculated intracutaneously in several places with a drop of sheep-pox lymph and nine days after inoculation the swellings were incised and the lymph obtained used for further ovination. The animal was then bound with an aseptic layer of cloth and the lymph which later exuded dried to form yellowish-brown crusts which were then crushed up and emulsified in the proportion of 5 grammes to 50 c.c. with normal saline solution, containing 0·5 per cent. carbolic acid, in a shaking machine. The emulsion was then filtered through three layers of muslin. This filtered emulsion was then titrated so that a dose of 0·02 c.c. contained the necessary amount of antigen for each haemolytic system.

In the case of four sheep inoculated with a drop of sheep-pox lymph into the ear the first indication of complement binding was obtained in from 10 to 31 days after the inoculation, or 3 to 23 days after the onset of symptoms; this phenomenon was most apparent in from 20 to 31 days after inoculation, or 13 to 19 days after the onset of symptoms, and remained distinct for 16 to 20 and appreciable for 35 to 48 days after the first appearance of the positive reaction.

In the case of four susceptible sheep placed in contact with affected sheep an appreciable reaction was obtained 9 days after the first appearance of skin lesions; 9 days later the reaction was distinct. The sera taken from 17 sheep in the scene of an outbreak gave distinct reactions in cases where the animals showed papules and crusts, while a somewhat less distinct reaction was observable in cases where the skin lesions had become cicatrised.

In the sera of healthy sheep no complement binding substances could be detected.

MISCELLANEOUS.

JONES (F. S.) & ARNOLD (J. F.). **Staggers in Sheep in Patagonia.**—*Jl. Experim. Med.* 1917. Dec. 1. Vol. 26. No. 6 pp. 805–823. With 4 plates comprising 13 figs.

The above two workers from the Department of Animal Pathology of the Rockefeller Institute for Medical Research investigated, at the instigation of a sheep-farming company of London, a nervous disorder of sheep which has become more prevalent during the past few years throughout portions of Patagonia. The disease is known under a variety of names—staggers, temblique, loco and huecù—and appears to be widespread for it exists throughout the pampa at least as far north as the Chubut Valley and extends southward to Descado and from the eastern boundary of the pampa to the Andes. The incidence varies greatly with the condition of the food supply. When there is a liberal amount of grass the number of cases is small but after a long continued drought, when the fine grass supply is short, the number of sick animals is large. The mortality varies considerably, and young sheep seem to suffer most. The disease is not confined to the ovine species alone; horses and cattle succumb readily to it. A disease similar to staggers was studied clinically in detail by ACOSTA (1914) and experimental feeding of a coarse tuft pampa grass (*Poa denudata*) to a horse, bullock and two sheep resulted in the production of definite nervous symptoms. His experiments were not controlled and inoculations were not attempted. Symptoms were said to develop in within 12–24 hours after the first feeding.

The authors then proceed to discuss the incidence of the disease amongst sheep, especially lambs, according to their age and the dryness of the season, from the reports of farmers. Peculiar neuro-muscular symptoms are described and well illustrated in the plates. Details are also given of a number of experiments performed which appear to prove quite conclusively that the disease cannot be transmitted by inoculation, but is easily set up by feeding with the coarse tuft coiron or pampa grass which grows in large quantities on the pampa at altitudes of from 500 to 1,500 ft. These tufts vary from 16 to 60 cm. in diameter and may reach a height of 40 to 50 cm. On a certain estancia on which staggers was prevalent there were three low paddocks situated at an altitude at least 200 or 300 ft. lower than the pampa; no matter how sparse the herbage became in these paddocks the disease never developed in the sheep kept there. When removed to the mixed pampa paddocks, however, staggers broke out, thus corroborating the results of the experimental findings. Horses brought on to the pampa from other districts often became affected with staggers in 24 hours. It seemed very unlikely that the disease could be a so-called "deficiency" disease inasmuch as THEILER, GREEN and VILJOEN failed to set up symptoms of avitaminosis in horses, cattle, and sheep feeding on a diet of 10 parts of polished rice and 1 part of autoclaved hay for long periods.

The prophylaxis of the disease would seem to lay in the direction of the eradication of the coiron grass but this would be a task of great magnitude as the grass is abundant from the foot hills of the Andes to the eastern boundary of the pampa. During the summer months when the grass is seeding the prevailing winds are from the west and it is not unusual for them to blow steadily for 3 or 4 days and attain a maximum velocity of 84 miles an hour. Even if this grass was eradicated from the western portions of the country it would soon re-appear. Burning off a portion of the land failed to kill the grass. Unless another grass could be substituted for it its eradication might cause considerable loss inasmuch as old sheep become tolerant to it and eat it without harmful effects. Probably during periods of drought many animals are dependent upon it for nourishment, and thus without the substitution of some other bulky food the losses from starvation might well equal the losses occurring from staggers. The authors draw up the following conclusions as a result of their observations and experimental work.

"1. Staggers is a non-infectious disorder affecting horses, cattle, and sheep.

"2. The disease is characterised by weakness, muscular twitching, irregular movements of the head, stiffness of the limbs, and transient motor paralysis, accompanied with spastic spasms on excitement. There is also a derangement of vision and conjunctivitis.

"3. The postmortem lesions are not characteristic.

"4. We readily produced the disease by feeding susceptible sheep on a coarse tuft grass commonly known as coiron or pampa grass (*Poa argentina*).

"5. The time required to produce definite symptoms by feeding the grass varied. Two animals developed typical staggers after two feedings ; in another instance a period of 21 days of feeding was required. The average time for the production of unmistakable symptoms in our experiments was 10 days.

"6. Many sheep recover from staggers spontaneously. A complete change of diet will usually effect a cure within 2 weeks.

"7. Older animals that have pastured for long periods on lands where the grass grows become tolerant and are rarely affected with staggers.

"8. The grass is toxic to sheep at all seasons of the year. We fed late winter and early spring grass and grass in flower, and produced staggers in every instance. The young green grass is as toxic as any edible portion of the plant."

CROSS (H. E.). **A Note on Jhooling in Camels.**—*Agric. Res. Inst. Pusa.* Bull. No. 72. 2 pp. With 2 plates comprising 4 figs. 1917. Calcutta : Supt. Govt. Ptg. India. [Price As. 2 or 3*d.*]

Jhooling or jhoolak is described as "a contagious disease of camels—manifesting itself in the formation of local tumours, hot and painful, of a fibrous character, and terminating in suppuration and raw patches."

The disease is widely distributed throughout the Punjab ; it is not so common in the Lahore District as in the Jhelum and Rawalpindi Districts. It usually occurs in the cold weather, but is met with occasionally in the hot weather. The causal organism has not yet been isolated but the author suggests that it is probably a fungus. The disease cannot be communicated to horses, buffaloes and cattle by placing them in contact with affected camels, and the lesions cannot be set up in these animals or in dogs, guinea-pigs, or rabbits by inoculation of emulsions of the lesions and by rubbing portions of the lesions on to the intact or scarified skin. On the other hand, rubbing of this material on to the scarified skin of healthy camels sets up the disease after a few days, and in one case only the disease developed after rubbing the material on the intact skin. Healthy camels kept in contact with affected camels contract the disease rapidly.

The lesion is first seen as a hot, hard, painful swelling varying from 1 to 5 inches in diameter and usually situated on the neck, hind quarters, or scrotum. After a few days the swelling becomes very irritating, and when situated on an accessible part of the body the camel gnaws at it with its teeth, leaving a raw patch. Suppuration takes place in all cases after a certain interval, and finally the wound heals leaving a small white patch which remains visible for several months. The diseased animal is usually affected with several lesions, which cause loss of condition. When situated on a part that comes in contact with the saddle they render the animal useless for work.

The lesion is composed of fibrous tissue with suppurating centres, the pus showing streptococci but no staphylococci. No lesions were observed in the internal organs.

As regards treatment the author specially recommends the application of a strong red iodide of mercury blister, which should be washed off with soap and water three days afterwards. The diseased areas are then excised and finely powdered potassium permanganate well rubbed in. Three dressings at intervals of four days are usually sufficient. Sometimes good results are obtained by excising the lesion and then applying pure carbolic acid. The wounds are then thoroughly washed with water on the following day and treated with the so-called " black wash."

As a preventive measure affected animals should be immediately isolated and the healthy animals divided up into lots and not allowed to intermingle ; these are carefully examined and if more cases are discovered they should be isolated at once. The disease spreads very rapidly among camels and causes a great amount of trouble. No camels should be bought if small hard white spots are noticed on the skin, for they undoubtedly represent healed-up jhooling lesions.

HOLBOROW (A. G.). **The Restraining Influence of Cyanide upon Oxidation in Arsenical Dips.**—*Rhodesia Agric. Jl.* 1917. Dec. Vol. 14. No. 6. pp. 733–737.

In this preliminary report the author describes a few experiments performed with the object of finding some means for inhibiting the formation of arsenate of soda from arsenite of soda in dipping fluids. The cause of this oxidation is apparently quite unknown. Micro-organisms have been suggested to play some part but the oxidation is not prevented by the addition of strong disinfectants such as formalin, corrosive sublimate, and carbolic acid. One method of preventing rapid oxidation is to agitate the dipping fluid in the tank by passing cattle through it at regular and frequent intervals. If dipping fluids are allowed to rest undisturbed they are liable to undergo complete oxidation very soon. It was found that the oxidation was not prevented by sterilisation of the liquid in an autoclave, boiling it for half-an-hour, or by passing the original dipping fluid through a bacterial filter. However, in one month after the addition of as small a quantity as 0·005 per cent. of potassium cyanide the oxidation had increased only 13 per cent., whereas the untreated dip showed oxidation to the extent of 83 per cent. in 11 days.

TRIBONDEAU (L.) & DUBREUIL (J.). **Nouveaux colorants pour microscopie dérivés du bleu de méthylène.** [New Stains for Microscopical Work derived from Methylene Blue.]—*C. R. Acad. Sci.* 1917. Apr. 2. Vol. 164. No. 14. pp. 551–553.

Inasmuch as considerable difficulty is experienced at the present time in obtaining satisfactory reagents for staining by the Romanowsky method in laboratories, the following short account by the above two authors of some products devised by them and already described in various other journals is translated almost literally; these products have been reported to us to have given highly satisfactory results.

There are numerous methods for causing the appearance in a solution of methylene blue of the two extremely useful derivatives for microscopic staining, viz., methylene violet and methylene azur. All these methods depend upon the action of an alkaline substance, viz., silver oxide in the case of Borrel blue, potassium carbonate in the case of Unna's polychrome blue, sodium borate in the case of Manson's blue, etc.

But, hitherto, no method of isolating methylene azur and violet has been published, and it is thus that we are dependent for these products and the staining solutions derived from them upon the German firms to which Giemsa has given his secret technique for the manufacture of azur. . . . We succeeded in manufacturing methylene azur and violet in a very simple manner:—Take a 1 per cent. solution of pure medicinal French methylene blue in distilled water, add 5 to 10 per cent. of liquid ammonia, and after mixing in a glass vessel heat on a water bath until the latter boils. An abundant precipitate is formed; filter hot on folded filter paper. The filtrate is allowed to evaporate in a large photographic dish placed in the incubator at 37° to 40° C. The residue after desiccation, collected by scraping and then powdered, is practically pure methylene violet.

As regards the precipitate a little is found on the filter paper but the bulk of it remains adherent to the walls of the flask. The filter paper and unstoppered flask are allowed to remain in the atmosphere for at least 24 hours, or, preferably, in the ice chest, in order to avoid evaporation of the moisture. Under these conditions the precipitate becomes coloured more and more intensely dark blue. When thus completely changed distilled water is added in which it then easily dissolves. Filter and treat this new filtrate as already described in the case of the preceding one. A second powder is thus obtained, viz., methylene azur.

The procedure, if properly carried out, should give approximately equal quantities of *ammoniated violet powder* and *ammoniated azur powder.*

These powders serve for the preparation of three staining solutions: (1) an aqueous solution of azur; (2) an aqueous solution of azur and violet called ammoniated *polychrome blue*; (3) an alcohol-glycerine solution of azur and eosin analogous to Giemsa's mixture for which the term *azéo* is proposed.

The *aqueous solution of azur* is made by dissolving 1 gramme of ammoniated azur in 100 c.c. of distilled water. This is utilised for staining liquids or organic products in the fresh state, between slide and cover glass. It is sufficient to mix 1 drop of stain with 1 drop of the product to be examined, cover with a cover glass border with some cement substance, and examine with artificial light. The staining process is progressive and then regressive. Good preparations are thus obtained of the cells contained in morbid extravasations and of the amoebae of dysenteric mucus. However, the results vary with the chemical reaction of the products studied.

Ammoniated polychrome blue is a mixture of 1 per cent. watery solutions of ammoniated azur and violet. The optimum proportion of the two constituents is ordinarily 1 part of the blue solution to 3 parts of the violet solution. This proportion is fixed by trial taking as a criterion the results obtained by staining sputa. In our routine practice we have substituted this mixed blue for carbol thionine and Unna's blue. It has the advantage of not decomposing like these stains. It is suitable for all simple bacterial staining but it is especially valuable on account of its remarkable and specific metachromatic properties for the examination of sputa and all organic pathological fluids (pus; secretions from the urethral and buccal ulcers; the deposit after centrifugation of pleural fluid, cerebrospinal fluid, etc.). The method of use is very simple. In the case of sputa the technique of BEZANÇON and JONE (with Unna's blue) serves quite well on the condition that fixation is carried out with alcohol and not with chromic acid. Other smears are fixed in alcohol, stained for 30 seconds to 1 minute, washed and dried. It sometimes proves useful to differentiate rapidly by means of absolute alcohol. Examination by means of artificial light is indispensable.

Azéo is made up of two solutions, viz., of 1 per cent. ammoniated azur and 1 per cent. French eosin, in each case in absolute ethyl alcohol containing a quarter of its volume of glycerine (alcohol 75, glycerine 25). The blue solution is poured gently into the eosin solution until they become neutralised and this requires a mixture of about equal parts of the two solutions. This mixture is allowed to stand for several days in order to give time for the azur and eosin to combine. An excess of the alcohol glycerine solution of azur is then added (about 2 parts to 8 parts of the above mixture). Staining with azéo is carried out in troughs as in the case of Giemsa. The dilutions (on an average 1 drop in 1 c.c. of distilled water), time and method of staining, and the various uses of the celebrated German stain are applicable to this stain with equal if not superior results. The fixation of the preparation to be stained can be carried out, as in the case of Giemsa, either by means of absolute alcohol or by means of the stain itself diluted with an equal volume of absolute alcohol. But the best results are obtained by fixing with bieosinate.* One is thus able to employ Pappenheim's panoptic method, but with bieosinate instead of May-Grunwald and azéo instead of Giemsa, and consequently with two French stains.

REPORTS.

NYASALAND PROTECTORATE. **Annual Report of the Department of Agriculture for the Year ended 31st March 1917.**—19 pp. f'cap. Zomba: Government Printer. [Price 6*d*.]

The following notes with regard to the state of veterinary affairs in the above territory occur in the abridged report of the Director of Agriculture [McCALL (J. Stewart)]. (pp. 4–5.)

"The southward spread of rinderpest in German East Africa has for the present depleted the Department of its entire veterinary staff, so it is impossible this year to include the usual report of the Veterinary Division.

"Dipping is now established in the Shire Highlands, and the general health of stock shows much improvement.

"Demodectic mange has been stamped out in most herds, and a small new centre of the disease in Marimba district was effectively dealt with by the slaughter of some thirty head of native owned cattle.

"It is interesting to record that when the dangers of the disease were explained to the natives they carried out veterinary recommendations without compensation.

"The Government Entomologist has, after most thorough investigation, mapped out the tsetse areas on the Shire between Matope and Liwonde. He can trace no fly areas adjacent to the Zomba-Blantyre road, where a considerable number of cattle contracted trypanosomiasis. No further cases have been reported on this road during the year.

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*[The manufacture of the above stain was described at some length by the above authors in *C. R. Soc. Biol.* 1916. Apr. 1. Vol. 79. No. 7. pp. 282–287.]

"On the Zomba-Liwonde road, 6 miles from Zomba, one case of trypanosomiasis occurred in the vicinity of the Naisi stream, but this is possibly caused by a stray infected fly or flies, and likely to recur in odd cases at any point within 20 miles of the Shire River (Matope-Fort Johnston).

"An outbreak of trypanosomiasis occurred in south-east Mlanje. The Government Entomologist, after thorough search, found no *Glossina morsitans* but *Glossina brevipalpis* was found near Sayama Estate, and is probably responsible for the disease.

"The distribution of *G. brevipalpis* will receive further consideration whenever the services of the Government Entomologist are available. Meantime stock-owners in the vicinity have been advised of the areas in which the fly were found."

SOUTHERN RHODESIA. **Report of Committee of Enquiry on African Coast Fever, Quarter-Evil and Epizootic Diseases of Cattle.**—38 pp. f'cap. 1917. Salisbury: Government Printer.

The work entrusted to the Committee of Enquiry was to enquire and report on (1) the origin of and circumstances attending recent outbreaks of African Coast Fever, (2) the adequacy of the measures taken hitherto to prevent and suppress African Coast Fever, and to suggest other measures, and (3) the circumstances attending the recent outbreaks of quarter evil, and (4) to consider measures for the control and prevention of epizootic diseases of cattle.

With regard to the first of these headings the Commissioners failed to establish "anything approaching definite proof as to the cause of the recent outbreaks." The questions detailed under the second heading resolved themselves mainly into the matter of tick eradication by enforcement of dipping regulations with dips maintained at efficient strength. The advantages that would ensue through the adoption of general dipping were agreed upon unanimously by the witnesses examined. Consideration was given to the best methods for maintaining dips at the strength necessary for killing the transmitting agents of African Coast Fever. Dipping at seven-day intervals was believed to be sufficient for killing off all ticks except the bont and bont-legged varieties which are not vectors of the disease. In such cases the veterinary bacteriologist was of opinion that "while one tick might be present by accident the presence of 10 ticks would indicate negligence." "Wherever dipping of cattle is required the presence of 10 engorged female ticks on an animal should be punishable." The means of providing financial help for the erection of dipping tanks were discussed, together with the fees to be levied on natives for their use.

Miscellaneous questions such as those relating to veterinary surgeons, cattle inspectors, restriction of cattle, permit system, cattle dealers, branding, fencing, and veterinary research were also enquired into. In the draft of the proposed Ordinance it was recommended that all owners of cattle in areas in which the "Compulsory Dipping Ordinance of 1914" is in force, and from and after a date to be fixed by the Administrator, all owners of cattle in areas other than temporarily exempted native reserves shall be required to clean their cattle. A scale of punishments for being in possession of tick-infested cattle is laid down.

Shortly after the fall of heavy rains in the Bulalima-Mangwe district in November 1916, several outbreaks of blackquarter occurred attended by considerable loss of cattle. Since that date the disease has spread to a large number of herds in Matabeleland. These outbreaks are regarded by some as the first occurrence of the disease in the country, but most probably it existed before the date of the European occupation and isolated cases of mortality from this cause in recent years were attributed to snake bite.

In the concluding pages the Government Veterinary Bacteriologist (BEVAN, Ll.E.W.) appends a report on the necessity for veterinary research in Southern Rhodesia. In the past this has been almost entirely neglected by the administrative authorities but Bevan elaborates data showing the advantages which would accrue, judging from the results obtained in British East Africa and the Union of South Africa, from the erection of a laboratory well equipped with personnel and materials for routine and research work.

> "It is generally believed that the future prosperity of Rhodesia chiefly depends upon the progress of the pastoral industry, and it has been freely asserted that the country is pre-eminently suited for stock. It is, therefore, somewhat disconcerting to find that after more than 25 years' European occupation 95,000,000 acres of land are carrying little more than one million head of cattle, the great majority of which are of inferior type, and in normal times too small and too slow to mature to be suitable for the meat markets of the world. This unsatisfactory state of affairs may be chiefly attributed to (1) *epizootics, e.g.*, rinderpest, contagious bovine pleuro-pneumonia and East Coast Fever, which have decimated our herds; and (2) other more *obscure diseases* which reduce the health and development of our domestic stock."

Research in connection with the above problems is thus of unquestionable necessity. Moreover, the authorities should be on their guard against importing disease from without, especially as there is a distinct risk of rinderpest making its way down into the country from British East Africa.

Details with regard to the staff required and salaries are suggested.

SOUTHERN RHODESIA. **Report of the Government Veterinary Bacteriologist** [BEVAN (Ll. E. W.)] **for the Year 1916.** 17 pp. f'cap. MS. Report received 1918. Feb. 1.

In this MS. report BEVAN gives an account of a fairly considerable amount of routine work and a series of interesting observations performed almost entirely by himself and with very niggardly support from his Government. The work of the laboratory is stated to have been maintained at a cost, exclusive of salaries, of a little over £300, and this appears to the reader to be out of all proportion to the importance of the contagious diseases of animals in this large tract of territory.

Out of over 2,500 smears and specimens from the field examined at the laboratory 120 smears revealed the presence of the organisms of East Coast Fever, 125 the parasites of other diseases, and 33 specimens of serum gave positive results as to the presence of contagious abortion in cattle.

The report contains a summary account of some of the results of the experimental work performed.

Horse sickness. In the absence of suitable animals for experiment, the Commandant General had placed at the disposal of the author horses recently imported as remounts for the Police. Eighteen such horses were inoculated by THEILER's method in 1915, and in the year under report 156 horses were also dealt with in the same manner with a loss of 20 animals. This result is considered to be very satisfactory although the resistance of the inoculated animals to natural infection had not been determined at the time this report was written. Three horses were taken, two of which had been previously inoculated, while one untreated horse served as a control; each was injected with virus taken from an animal that had died as the result of inoculation. The control horse died on the sixth day while the two vaccinated animals remained unaffected. Another police horse which had been inoculated in October 1915 was again inoculated in September 1916 with virulent blood; no reaction followed. Mules inoculated according to THEILER'S method have proved resistant to horse sickness in most districts of Southern Rhodesia. As immunity towards one strain of virus does not necessarily afford protection against infection by another it is anticipated that when inoculated police horses are distributed throughout the country many of them may become infected with a strain of virus peculiar to the district to which they are sent. There is, however, some evidence to show that the mortality in such cases is considerably less than in the case of uninoculated animals provided they are rested during the attack. During the year 1912–1913, 45 out of 207 police horses died of horse sickness, and in 1914–1915 41 died out of 193. It was feared that the horse sickness season at the time of writing would be exceptionally severe owing to the early and continuous rains.

" *The Plasmoses of Cattle.* More general application of the principle of 'short interval' dipping has, to a large extent, reduced the losses due to these diseases, and at the present time there are farms to which cattle imported for the improvement of local herds can be introduced with safety without inoculation, and upon which the improved progeny grow up free from the tick-borne diseases. Although the advantages thus derived are great it must be remembered that the dipped areas in the country are far exceeded by those where the principle is not carried out and ticks and the diseases transmitted by them are prevalent. Thus in practice there would appear to be three stages in the development of a herd; the first, or pioneer stage, when imported animals cannot be used for the improvement of the nucleus of native cattle unless inoculated, and when a heavy mortality of young stock must be expected from redwater and allied diseases; a second stage, when by systematic dipping the veld becomes tick-free, and imported stock can be introduced with impunity and the young progeny grow up and thrive free from disease; and lastly, the stage when the animals bred upon such areas being susceptible to tick-borne diseases cannot be exposed to tick-infested veld so that the market for them becomes restricted. Therefore, in spite of the progress and advantages of systematic dipping there are certain disadvantages associated with it until the system becomes universally practised. In the meantime there remains the necessity for a satisfactory method of inoculation for the protection of imported bulls exposed on infected veld, and of young stock born upon tick-free farms, in order that they may be disposed of with safety beyond the limit of such areas. During the past ten years efforts have been made to discover a satisfactory means of conveying immunity, but experiments have unfortunately been handicapped by the extreme cost of experimental animals which have of necessity to be imported from countries free from these diseases; but from time to time consignments of cattle have been imported by progressive breeders anxious to improve the class of cattle in this country and the Veterinary Department has been called upon to inoculate them to the best of its ability. Thus in 1911 ninety-four bulls were imported and were inoculated with a loss of 5 per cent. only, but many of these were inoculated with a virus supplied from the South and did not prove immune when exposed to natural conditions. Others, inoculated with a local strain of virus, suffered more severely at the time of treatment, but subsequently proved immune.

The utility of such animals is somewhat impaired during their first year in the country, but record of many of them are available and show that some of them have taken honours in the show ring, notably the bulls "Baronet" and "Aeriel Knight," and a considerable number have been responsible for as many as two to three hundred progeny, of improved type and bearing the impression of the sire. Again, in 1912 about sixty-eight animals were imported from overseas, twenty-five home bred animals died, but it should be pointed out that their owners had been previously warned that such stock was unsuitable for inoculation on account of age, soft condition, pregnancy, or in-breeding, and the inoculation was undertaken under protest. Nevertheless, in spite of the heavy mortality the survivors have proved a profitable investment, more than paying for the losses, the progeny of some of the inoculated females having been sold for three figures. In 1913 ninety-four cattle from Great Britain were inoculated with a loss of twenty-seven; this mortality which took place during the absence of the Bacteriologist was probably due to some unaccountable exaltation in the strength of the virus used, and it was thought wise to suspend further inoculations until the process could be placed upon a safer basis. Since then no privately owned imported stock has been accepted for inoculation until October last, when eleven animals were received for treatment at the Laboratory, the inoculation of which is not yet completed. During the interval, however, two small consignments of young cattle from England have been imported for experimental purposes and different strains of virus have been tested with the result that it is now hoped that given suitable animals and proper accommodation, the principle can again be applied upon a large scale. It has been abundantly proved that to obtain the best results, animals submitted for treatment should not be too fat or pampered, or too highly bred, and should not exceed fifteen months of age. The mortality among such animals should be insignificant and recovery from the slight set-back caused by the operation should be rapid. Now that Rhodesia has with her limited supply of high-grade animals entered the meat markets of the world, no time should be lost in bringing up the bulk of her stock to the same standard of excellence as that exhibited by the sample consignments.

"*Trypanosomiasis.* In January it was reported to the Veterinary Department that a large number of pigs were dying from some unknown disease at two farms on the Northern border of the Umfuli River, In one herd of one hundred and fifty as many as twenty pigs had died, and a large number at the time were showing symptoms of the disease, and in the second herd of about fifty pigs five had died and many others were severely sick. Examination of smears submitted from sick animals revealed large numbers of trypanosomes of pecorum group, but differing slightly morphologically from the trypanosome commonly met with in cattle in the Hartley district, notably in the fact that the body appeared more flexible and the undulating membrane more highly festooned, so that in fair specimens it was afterwards possible to distinguish the two by microscopic examination. One particular feature of interest in connection with the outbreak was that although the Hartley district has been known since the early days to be an area infested by *Glossina morsitans*, no tsetse fly had ever been encountered in the particular position where this outbreak was occurring and there was every reason to fear that the disease might be transmitted by biting flies other than the tsetse, or by some other means. Such a possibility was alarming, since the experience and research of the past ten years has led to the conclusion that as far as the trypanosomiasis of animals in Southern Rhodesia is concerned, it is seldom if ever transmitted from sick to healthy in the absence of the tsetse fly. That certain forms of trypanosomiasis can be so spread is admitted, and examples have been met with in neighbouring territories; but it would appear that in such instances certain conditions are necessary, which may almost be laid down as axiomatic, viz., an original source of infection, generally an animal infected by the tsetse fly; an abundance of trypanosomes in the peripheral blood of the animal; very close contact between sick and susceptible animals; a vast number of transmitting agents, and finally certain climatic conditions of warmth and humidity. These essential conditions are seldom if ever met with in Southern Rhodesia. In order to study this disease of pigs one or two infected animals were sent to the laboratory. With the virus thus supplied experiments were undertaken to ascertain the nature of the parasite and its infectivity to domestic stock, its transmissibility other than by the bite of the tsetse fly, and to obtain as quickly as possible a means of treating and preventing the disease caused by it. It was found that this disease could easily be transmitted from pig to pig by artificial inoculation of small quantities of blood, giving rise to a disease rapidly fatal, killing untreated animals in less than thirty days. Small laboratory animals did not become infected even by repeated doses of virus from a natural case, and sheep and cattle exhibited a marked degree of resistance. Transmission experiments undertaken proved negative and a natural experiment showed that infection from sick to healthy was not readily effected by biting flies. At the Laboratory sick and healthy were closely stied together and were continually pestered by swarms of stomoxys which were noticed to pass from one to the other. Nevertheless no infection of the healthy took place except by means of the syringe. Thus the manner in which so gross an infection can have been brought about under natural conditions remains to be shown. The problem of greatest importance to be solved was to find a means of protection and treatment. For several years the trypanosomiasis of Hartley cattle had been found to yield to massive doses of antimony and arsenic. But the former drug had to be carefully injected into the vein, because if it made its way under the skin it gave rise to severe abscesses and sloughs; it could not therefore be applied in the same way to pigs, and, further, its beneficial effect upon bovine animals was largely due to their peculiar tolerance to antimony. It was necessary therefore to discover a form of the drug which could be administered to pigs without harmful effects and this was finally met with in a combination of emetic and arrhenal which was applied with most favourable results; but it has to be admitted that in the great majority of cases a complete cure was not effected but merely, as in cattle, a state of tolerance established, enabling treated animals to live in apparent health until adverse conditions reduced their resistance and once again the trypanosome re-asserted itself and produced its harmful effects. Thus in one herd the results were most favourable and the disease was arrested so that the great majority of animals could be fattened off and disposed of, but in the second herd, where the owner failed to supply an adequate diet, the good results of the treatment were but temporary and most of the animals died.

"During the year a few experiments have been conducted in connection with other forms of trypanosomiasis; the appearance of *T. brucei*, var. *rhodesiense* in donkeys working at the junction of the Umfuli and Umnyati rivers indicates that the distribution of this form of infection is greater than was supposed, and in view of the possible transmission of the parasite to man by *G. morsitans* and the invariably fatal disease set up, experiments were conducted with remedies for which success has been claimed by workers in European laboratories. The most important of these was that recommended by Daniels and Newham in the *Lancet*, January 8th, 1916, p. 102, who claim to have permanently cured a case of human infection with *T. rhodesiense* by subcutaneous injections of 30 minims of Martindale's solution (injectio antimoni oxidi) given subcutaneously twice a day.* This drug, when applied to pigs infected with the small trypanosome of the *pecorum* group, in the dose recommended, produced no appreciable effect. Martindale's solution is supposed to contain one-hundredth of a grain of antimonious oxide in 1 c.c. of glycerine and water equal parts. Nevertheless infected pigs and sheep received quantities containing as much as 0·5 gm.

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*Mr. Bevan is not quite correct here. There was no claim to permanent cure. The preparation was recommended as one of antimony that could be injected under the skin without causing necrosis, abscess, or severe pain. It was tried in one instance and the trypanosomes had been absent for a fortnight when the communication was sent to the *Lancet*. "Possibly the preparation may give as satisfactory results as atoxyl." [See also *Tropical Diseases Bulletin*, Vol. 7, p. 106].—[GEN. ED.].

of antimonious oxide without harmful effect, but without beneficial results or apparent influence upon the course of the disease. An ox naturally infected received up to 2 gm. of the salt in suspension but the parasites did not disappear from its blood and the animal died from trypanosomiasis six days after the last injection. The results with this agent were very disappointing, as difficulty was being experienced by the military authorities in passing animals through the fly belts of Northern Rhodesia on their way to the Northern Frontier of operation, mules becoming infected and useless for transport work and fly-struck cattle proving unsuitable for human consumption. The use of tartar emetic although beneficial, had its disadvantages owing to the difficulty in application and dangers of local injury, and it was hoped that if the tri-oxide of antimony was equally effective and could be applied subcutaneously in the form of a cream, it might take its place with advantage. Unfortunately experiments showed that the results obtained were by no means as good as those following the use of emetic, and the treatment could not be applied in practice.

"*Dipping of sheep.* Reference may be made to an experiment carried out at the request of the Chief Veterinary Surgeon to ascertain the effects of 'short interval dipping' upon sheep and lambs. A small flock made up of thirty nine sheep and lambs of mixed breeds, the majority being half-bred persians, but six of long-woolled varieties, were purchased for the purpose. All these animals were in a most emaciated condition and suffering from fluke, wireworm, tape-worm and the nodular worm of the intestines. It was with difficulty that they were driven from the farm from which they were purchased to the laboratory. On the 5th February dipping was commenced in Cooper's dip, one in three hundred strength, in which they were immersed three times in ten days: the strength of the dip then being increased to one in two hundred and fifty. Dipping was carried on regularly twice a week in this strength until the 16th April, making nineteen dippings in all. During this period ten animals died, viz., four sheep (one woolled) and six lambs, these being the weakest of the flock. The rest of the flock improved markedly in health. The experiment was then discontinued but the result is still apparent in that the survivors are still alive and in the best of condition, and the ewes have given birth to lambs which have thrived and grown out in spite of the fact that most of them have been born during the dry season. The experiment was originally intended to determine to what extent small stock could be dipped with safety in areas which have to be freed from African Coast Fever.

"It is probable that such drastic measures could not be applied in a damp atmosphere, or to woolled varieties because of the damage to the fleece, but in practice this would not be necessary. The experiment, however, has gone further in affording support to the observation of officers in the field that dipping exerts a beneficial action upon sheep infected with worms. The results have been so remarkable that when opportunity arises further experiments of a more exact nature will be carried out."

Contagious abortion. Owing to the local peculiarities of the country the author is not certain of the best means of dealing with it. Besides the application of quarantine restrictions, isolation of affected animals, and removal of the bull from the herd vaccination was practised in several instances. The method of vaccination apparently consisted in the inoculation of large doses of dead cultures and favourable results were alleged to have been obtained after the use of this method by officers in charge of the outbreaks. The issue of a living vaccine is considered to be unsafe in Southern Rhodesia where the means of transport are often primitive and where it is often impossible to tell whether an animal is pregnant or not. Experiments are said to have been conducted to test the relative value of (*a*) living vaccine, (*b*) carbolised vaccine, and (*c*) vaccine killed by heat, from which it was found that a vaccine of *B. abortus* killed by extreme heat gave rise to a reaction almost as great as that produced by a living vaccine, but of a somewhat shorter duration. The reaction was apparently measured by the agglutination titer of the blood of the experimental animals, but, as the author himself admits, " agglutinins are not identical with immunity although they do to a great extent run parallel to it."

[In support of his contention that good results may be obtained by the use of dead vaccines the author says: " As the result of experiments conducted by the Board of Agriculture in England, the protective inoculation of cattle against contagious abortion has proved successful when the vaccine has consisted of ' massive ' doses of living organisms, but equally good results have not been obtained when vaccines have been killed by heat. On the other hand, a certain firm of repute continues to issue a dead vaccine and claims good results from it." It need hardly be pointed out that one usually weighs evidence as to the value of any product in the treatment of disease by a critical examination of published results, and not by ascertaining its saleability through commercial concerns.—ED.]

Various. A kaffir onion known as " Chitupatupa " and the root of a bush known as " Mutsura " used by natives for poisoning pools when catching fish were suspected of having set up outbreaks of poisoning among cattle. Feeding experiments proved that these materials were harmless when fed in comparatively large doses. An outbreak of tuberculosis in a herd is briefly discussed.

UGANDA PROTECTORATE. **Annual Report of the Department of Agriculture for the Year ended 31st March 1917.**—48 pp. f'cap. 1917. Entebbe: Government Printer. (Report of the Chief Veterinary Officer [HUTCHINS (E.)]. pp. 27–31.)

Diseases of Cattle. Rinderpest. This disease first appeared in the Mengo district of the Buganda Province in August 1913, and during the next two years it extended into other districts. Since March 1916, there have been no outbreaks of the disease amongst cattle or game in the Province, which is now at last free from this disease. " The epidemic was kept under control by the quarantine regulations, which were, on the whole, well observed and it was finally eradicated by the double inoculation of the greater proportion of all cattle in the infected areas, and also of those in the adjoining clean areas." During the three years in which the epizootic was prevalent in the district 23,000 cattle were immunised, being from one-half to two-thirds of the total estimated number of cattle in the infected areas. The number of uninoculated cattle which died during this period is estimated at 12,000. Numerous outbreaks were reported in some districts of the Eastern Province and in two districts of the Northern Province.

Rinderpest has never spread into the Western Province, which contains 350,000 cattle. The disease is widely prevalent in the territory to the south of the Uganda Protectorate.

" Rinderpest, which for the past seven years has taxed all the energies of the Veterinary Staff, has at last been brought under control to the extent that the only areas where it exists to-day are in the remote districts bordering the Sudan and British East Africa, and thus all danger of the epidemic extending through Uganda to Southern Africa has for the time being been removed.

"*Trypanosomiasis.* Losses from trypanosomiasis were not so serious amongst native herds in the Buganda and Western Provinces as in previous years. Only one outbreak was reported in the Mengo District, in Northern Singo.

"A large proportion of the Military Transport cattle working on the Bukakata-Mbarara road became infected and some transport teams owned by Indian traders also suffered heavily. There are no tsetse on this road but it is possible that some of the oxen became infected near Bukatata where *Glossina palpalis* is found on the lake shore.

"A number of the Government Transport oxen died from this disease on the Fort Portal-Mubendi road. There are no tsetse on this road. The source of infection was probably some transport cattle sent from Kampala to Matiri, the Transport Depot at Mile 161. The trypanosome (*T. pecorum*) would appear to have been transmitted at Matiri by *Tabanidae* and *Haematopota* which were exceptionally numerous there during the rainy season.

"In Kampala nine of the Municipal oxen became infected with *T. pecorum*. These were isolated and treated by intravenous injections of antimony potassium tartrate. Three (Nos. 2, 3 and 6) have recovered, their blood is not now infective for dogs and their general condition is good. Three others though still infected are improving in condition.

"Four (Nos. 8, 9, 10 and 11) out of five which became infected with *T. pecorum* in February, 1916, and received the same treatment recovered, and have been working regularly since May, 1916. The results from this line of treatment are the most promising of any yet obtained here and further experiments are being carried out this year.

"In 1914-1915, 28 of the Municipal oxen died from trypanosomiasis. In 1915-1916 eight died and in 1916-1917, two died. A microscopic examination of the Municipal oxen is now made weekly.

"Losses amongst cattle from trypanosomiasis, which became infected in areas in which no tsetse exist, have in past years been very heavy in Buganda. This is the most serious veterinary problem with which we have to deal. It is the greatest obstacle to the development of cattle transport in the Buganda and Western Provinces.

"The primary source of infection is the tsetse in the fly areas. Cattle, having become infected there, and subsequently being brought into contact with healthy herds in fly-free areas, have caused extremely heavy losses both amongst native herds and transport oxen.

"Many such outbreaks amongst cattle have occurred in areas in which tsetse have never been found, and in which the other domesticated animals do not become infected.

"In these cases the infection appears to be transmitted with most certainty by Tabanidae where these are present in any numbers. In some outbreaks stomoxys, and possibly haematopota, appear to have been the transmitting agents.

"Hitherto it has not been possible effectively to control the movement of cattle out of or through areas in which tsetse exist, but as these areas become better known and more accurately defined it should be possible, by the control of stock routes, to avoid the passage of cattle through fly areas and thus to bring about a very material reduction in the danger of infection from this source.

"*East Coast Fever.* This disease is endemic over the whole of the Buganda Province. In the Eastern Province it is not endemic in the Bugishu counties on the foot-hills of Mount Elgon nor in the north-eastern part of the Teso District. More work requires to be done in mapping out the non-endemic areas in the Eastern Province and in testing the immunity of cattle from outlying and more recently administered parts of the Province.

"Money has been sanctioned for the construction of a cattle dip in Kampala during this year.

"The grazing in and around Kampala is very heavily tick-infested, and it is hoped that when the regular dipping of cattle has been established, together with the eradication of ticks, a reduction in the number of biting flies which molest the cattle may also be effected by this means.

"In the Mubendi District a number of water buck died in November and December. When the first reports of game dying were received it was thought possible that rinderpest might have spread eastward from the Congo. Investigations made in January showed that deaths were due to an extraordinary heavy infestation by brown ticks. Filaria were found on examination of blood slides obtained from water buck.

"*Foot-and-Mouth Disease.* Foot-and-mouth disease has been more than usually prevalent during the past year, particularly in Ankole and Toro.

"At Mbarara there was an outbreak of a severely malignant form amongst the Military Transport and Supply cattle and a high percentage of the infected died. There were outbreaks of a very mild type in Kampala during February and March. No cases have as yet been seen in any animals except cattle.

"*Diseases of Goats and Sheep.* Contagious pleuro-pneumonia of goats was responsible for the deaths of a very large number of goats obtained from Ankole and Toro for the supplies of the Military forces on the Southern Frontier.

"In Karamoja, where the natives possess large flocks of sheep and goats, very heavy losses were reported during the exceptionally wet season in that district.

"Goat scab has been prevalent in the Teso and Bukedi districts and has caused very considerable mortality.

"*Diseases of Equines. Ulcerative Lymphangitis.* Eight cases amongst mules were reported. Lymphangitis was very prevalent amongst the Military mules on the Southern Frontier but most of these were kept going under treatment.

"*Trypanosomiasis.* Six deaths occurred in mules in the Southern Frontier from this disease.

"*Diseases of Dogs.* 37 cases of Piroplasmosis were treated in Kampala. Almost all of these recovered. One dog brought from Masindi to Kampala was found to be infected with *T. brucei* and died on arrival here."

UNION OF SOUTH AFRICA. **Department of Agriculture. Report with Appendices for the Year ended 31st March 1916.**—160 pp. f'cap. 1917. Cape Town: Cape Times, Ltd., Government Printers. [Price 3*s.* 6*d.*] (Appendix III. Veterinary Research. Annual Report of the Director [THEILER (A.)]. 1915–1916. pp. 45–49.)

This report first deals with a very considerable amount of routine work performed at the Onderstepoort, Grahamstown, and Pietermaritzburg Laboratories, consisting in the examination of smears and morbid specimens and the manufacture of vaccines against blue tongue, redwater and gall-sickness, anthrax, and blackquarter, the inoculation of mules against horse sickness, and agglutination tests for contagious abortion and glanders.

Besides this large amount of routine work a considerable amount of investigation into the nature of important animal diseases was performed. Full accounts of the experiments in connection with some of these diseases are promised in the Director's forthcoming Annual Report. A brief survey of the work done and the results obtained is given and on account of its importance it is reprinted as follows:—

"Generally speaking the year has been conspicuous by an enormous increase in the routine work, the natural result of which was a corresponding diminution of research. The lack of opportunity for research work was further accentuated by the absence for some months of several members of the staff on Active Service, amongst whom were two of my seven Veterinary Research Officers.

"The two main subjects of investigations were Lamziekte in cattle, and Horse sickness, and I have dealt with these matters more fully.

"(1) *Lamziekte in Cattle.*—The investigations into Lamziekte are still being carried on at Armoedsvlakte, Vryburg, under the supervision of Mr. Viljoen. The initial object was to verify and control the results of investigations published by Professor Hedinger, with particular reference to the opinion expressed by him that Sarcosporidia were the cause of Lamziekte. At the outset this task seemed almost impossible of solution owing to the lack of information concerning the life history of these parasites, and although many other investigators had attempted to settle this question their efforts had not met with success. Under these circumstances I decided to continue investigations on the lines adopted by Professor Hedinger, but in addition to extend them so as to include the examination of material obtained from cattle that died on Armoedsvlakte from any cause whatever. In this way the examination of sections cut from muscles of different animals enabled me to compare the number of Sarcosporidia and the extent of the pathological lesions they caused in the cattle that died of Lamziekte and in those that died from other causes. The net result is that Sarcosporidia are found in all cattle, particularly in cattle in poor condition, and this latter fact was so obvious that we came to the conclusion that Sarcosporidia may be the cause of an illness, or anyway a cause of poverty, but not a cause of Lamziekte. This conclusion is supported by the fact that pathological lesions found in cattle showing a large number of Sarcosporidia are in no way associated with the lesions found in cattle that die of Lamziekte. Finally in Lamziekte animals a minimum number of parasites are found with a maximum of pathological changes indicating that the latter cannot be caused by Sarcosporidia. Accordingly, although investigations into relationship of Sarcosporidia to disease will still be continued, the one conclusion arrived at so far is that these parasites have no connection with Lamziekte.

"Accordingly I have had to return to the grass toxin theory, which still offers a better explanation for the cause of Lamziekte than any other, and using this theory as the basis for further research a new programme was planned and is now in course of operation. It is of interest to note that the disease has been located in a 12 acre paddock at Armoedsvlakte, and a thorough botanical survey has been undertaken by Mr. Pole Evans, with whose assistance feeding tests with plants (both infected and free from fungi) are now being undertaken.

"It had been my intention to lay out an artificial grazing ground at Armoedslakte to see whether Lamziekte would still be contracted by cattle grazing on such a pasturage, but the ground proved unsuitable for ploughing, and I therefore decided to undertake this work at Bestersput, near Bloemfontein. All the necessary arrangements have been made there and cattle transferred in readiness but no disease has appeared so far. A new experiment has been planned and partially carried out by removing soil from a Lamziekte to a non-Lamziekte area with the object of seeing whether the disease can be transferred. A number of possible preventive and curative measures have been attempted including injections of Trypanblue, Methylene Blue, Chloral Hydrate, Formalin, etc., but without success.

"(2) *Imapunga in Cattle.*—This disease of the Eastern Province is under investigation by Mr. Wm. Robertson of the Grahamstown Laboratory. Sixty head of cattle have been exposed on the farm Palmerstown and preparations made for inoculation and drenching experiments in the Laboratory. No disease has appeared so far amongst the exposed cattle.

"(3) *Contagious Abortion in Cattle.*—The object of these experiments was of a practical nature, based on enquiries made by various correspondents, and can be summarised as: (1) To see whether clean cows can become infected by a bull which has previously served cows that have aborted but have been isolated for at least 18 months and not allowed to be served. (2) To see whether it is possible by means of serum tests at intervals of two months to separate the infected cows from a herd in such a manner that the clean ones remain clean and no further positive reactions are obtained. (3) To see whether cows which have aborted and have calved normally afterwards are really immune and have not merely recovered though still capable of being re-infected. (4) To see whether in a cow which has calved normally, though a reactor, the bacillus of contagious abortion is present in the milk or other excretions, and whether in the case of such a cow dying, the bacillus can be isolated from the uterine mucous membrane, etc. These experiments will have to be continued for another year, and although a considerable amount of information has been obtained, it is too early yet to make any announcement.

"(4) *Horse-sickness.*—The main objects of the past year's investigations have been two-fold, i.e., firstly, to improve the method of inoculation for rendering horses immune against the disease, and, secondly, to ascertain the protective value of dipping.

"The experience of previous years showed that the immunity conferred by inoculation was insufficient to protect horses against natural attacks of the disease and a considerable number had break-downs. Attention was, therefore, paid to this point whilst at the same time efforts were made to reduce the loss from inoculation.

"The desired objects have been satisfactorily achieved by the injection of two viruses, the second one being the virus that has been used successfully during the past few years for the inoculation of mules.

"Up to the end of the financial year this amended method has been used on 314 horses, of which 11 died as a direct or indirect result of inoculation, or 3·5 per cent.

"From these figures it will be seen that the mortality amongst horses is slightly higher than that experienced in mules, but even so it is better than our most sanguine hope of a 5 per cent. mortality. It now remains to be seen whether the low mortality can be maintained on a large number of horses. The immunity conferred by the improved method of inoculation has been tested by exposure experiments on 49 horses that were running at Onderstepoort during the worst time of last season. Two out of the 49 horses died of Horse-sickness, whilst three others contracted the disease and recovered, showing that a mortality of about 4 per cent. from relapses must be expected. The details of the investigations and experiments with the method of inoculation are now being compiled for publication in the Research Report.

"(5) *Dipping Experiments.*—Experiments to ascertain whether horses could be protected against Horse-sickness by periodical dipping were undertaken with the approach of the Horse-sickness season; 40 horses were sent to the Maritzburg Laboratory and 160 were kept at Onderstepoort, all of them being now dipped at different intervals in various dips and mixture.

"(6) *Pernicious Anaemia in Horses.*—Shortly before the outbreak of hostilities in Europe in 1914 a report was published by the Seyderhelms (father and son), of Strassburg, to the effect that Pernicious Anaemia was produced through the agency of Bots, and an announcement to this effect appeared in the South African Press. *A priori*, South African experience in the past seemed to negative this idea, but nevertheless it was deemed advisable to put the matter to the test at Onderstepoort. The result of our experiments was that Bots collected from the stomach of a horse that died of Pernicious Anaemia, when emulsified and injected into a susceptible horse, produced the disease in practically every instance. Further, Bots collected from the stomach of a horse not affected with Pernicious Anaemia did not produce the disease when injected into healthy horses. These were the results that we expected, showing that the Bots itself cannot produce Pernicious Anaemia, and although an emulsion of Bots collected from an infected horse produced the disease, it is a different matter whether Pernicious Anaemia could be transmitted through the medium of the adult flies (i.e., from larvae taken from horses with Pernicious Anaemia and by means of their eggs deposited on a susceptible horse).

"(7) *Wire Worms in Sheep.* The life history of the wire worm has been investigated further and much valuable data collected, which will serve as a basis to assist in the fight against the wire worm pest. Details of this work appear in the 3rd and 4th Scientific Report of the Director of Veterinary Research. It may, however, be stated that the mixture of Cooper's Dip and Blue Stone recommended by the Division, particularly when administered to infected sheep on two successive days, is such a powerful remedy that it expels practically all the worms from their stomach. The remedy for wire worms is, therefore, a simple one, but their eradication cannot be expected from the medicines alone, and attention must be paid to the general management of sheep based on the life history of the worm itself.

"(8) *Trypanosomiasis.*—The investigations into Trypanosomiasis in Zululand, under the care of Mr. Mitchell, must be considered as a continuation of those undertaken last year by the Museum Expedition, the results of which corroborated the findings of the early investigations of Sir David Bruce, i.e., that game are infected with Trypanosomes (in our experiments Impala, Bushbuck and Zebra). The objects of the present investigations were not so much the repetition of the Museum Expedition work, but more to find out the extent of infection of Trypanosomes in Zululand, with particular reference to the spread of the disease and to the best means of prevention and eradication.

"An interim report has been submitted by Mr. Mitchell in which the following conclusions were drawn:—

"1. Wandering game are responsible for primary outbreaks of the disease.

"2. Tsetse flies will not travel from the original fly belt unless cover is continuous or in company with game.

"3. In the absence of Tsetse it is unlikely that outbreaks of Nagana could originate from recovered or partly recovered cattle or from game localised to the cattle grazing area.

"Certain recommendations have been made by Mr. Mitchell, with a view to localising game as far as possible and for their efficient protection in the Reserves, i.e.:—

"1. The issue of permits to Europeans and natives living in Nagana areas authorising them to destroy 'wandering game,' in preference to indiscriminate shooting and 'drives.'

"2. Such permits should be valid during the summer months as well as during the 'open' season.

"3. The destruction of game in infected areas should be encouraged by the issue of licences at reduced fees to non-residents.

"4. In the low veld areas where few if any cattle are to be found and in areas surrounding game reserves, the shooting of game under licence should be allowed.

"5. The effect of the above recommendations would necessitate increased supervision in game reserves, which could be effectively obtained by the appointment of an European ranger for each reserve and the surrounding district.

"6. The existing 'open' area on both sides of roads should be maintained for some time.

"7. The bush adjoining roads passing through tsetse fly areas should be repeatedly burned, and road repairs should be carried out at regular intervals.

"8. Finally, the assistance of owners is necessary to control Nagana, as insufficient herding, transport riding in summer in areas where the disease is endemic and lack of isolation measures are matters for owners to deal with and not the State.

"(9). *Gouw Ziekte in Sheep.*—An opportunity offered itself in the neighbourhood of Pretoria for further research in connection with this disease, and feeding experiments were undertaken to control the negative results obtained in the Lake Chrissie district in 1909. Investigations are now proceeding with the object of ascertaining the particular plant responsible but definite results are not yet to hand.

"(10). *Geel Dikkop in Sheep.*—This disease was brought to my notice for the first time this year, reports of outbreaks being sent in from the Hope Town and Colesburg districts. Mr. Walker was instructed to make local investigations and experiments were at once undertaken to ascertain whether the disease was infectious.

"Inoculation experiments were carried out but so far have proved negative, thus corroborating the results of earlier investigators. Muzzling experiments have also been undertaken to see if the disease is contracted through the mouth. Feeding experiments were also taken with Dubbeltjes, a plant considered by many farmers to be the cause, but without result.

"(11). *Ornithodoros Megnini. The Spinose Ear Tick.*—In 1912 a tick new to South Africa was discovered by this Division, and this year numerous reports have been made from various parts of the Union as to its prevalence. Mr. Bedford, the Entomologist of this Division, made personal enquiries in the Richmond area, and it appears that the tick is responsible for a considerable amount of trouble in sheep, goats, and calves—a short memorandum has been published giving our recommendations for the treatment of affected animals.

"(12). *Stiff-sickness in cattle and so-called 'Rickets' in Donkeys and Sheep.*—Enquiries into these diseases and the collection of material have been undertaken whenever opportunity occurred, and a considerable amount of material has been obtained, which will be worked up when time and staff permit.

"(13). *Jagziekte in Horses.*—Investigations into this disease are being carried out in Pietermaritzburg, the primary object being to reproduce the disease artificially.

"(14). *Dunsickness in Horses.*—Investigations into this disease are being continued at Onderstepoort and Pietermaritzburg. In Pietermaritzburg attempts are being made to produce the disease with worms which are commonly found in the Caecum and Colon of horses affected with Dunsickness. In Onderstepoort feeding experiments are being made with a plant, known as Ragwort, which is believed to have some connection with the disease. The plant has killed two horses, but the symptoms of Ragwort poisoning differ from those found in Dunsickness and further experiments will be necessary.

"*General Remarks.* It must be pointed out that notwithstanding the number of subjects coming under the heading of 'Research' which have been enquired into, only in three cases has it been possible to carry out investigations on systematic lines, and they are Horse-sickness, Lamziekte, and Wire Worms in sheep. The other diseases have been dealt with more for our own information at present with the object of collecting as much evidence as possible in a rough and ready manner. The minute and detailed examination that these other diseases deserve could not and will not be carried out unless more time is saved on routine duties or unless the staff is increased in proportion."

UNITED PROVINCES. **Annual Report on the Civil Veterinary Department for the Year ending 31st March 1917.** [HICKEY (S. G. M.), Acting Superintendent.]—22 pp. f'cap. With 14 tables. 1917. Allahabad: Superintendent Government Press. United Provinces.

During the year under consideration the reported mortality from various contagious diseases amounted to 15,473 cases. Rinderpest was responsible for 7,563 of the deaths recorded.

Equine contagious diseases coming under the control of the Civil Veterinary Department occurred in four selected horse-breeding districts. Glanders broke out in six districts, and 41 animals either died from it or had to be destroyed. A severe form of surra occurred in one district where 118 animals either died or were destroyed. Many cases of tetanus were reported, of which 31 proved fatal. No cases of dourine or epizootic lymphangitis were detected. There were 599 cases of strangles, eight of which proved fatal. Equine piroplasmosis, horse pox, influenza, anthrax, and parasitic skin diseases occurred to some extent, but no statistics were available.

Bovine diseases. Rinderpest occurred in a more severe form than in the year 1915–16, most districts having been more or less affected. The total mortality during the year was reported as 7,563, as against 3,767 last year. Inoculations were carried out against it in 33 districts. Haemorrhagic septicaemia caused 1,777 deaths, as against 1,593 in the preceding year. The disease assumed a virulent form only in five districts. Foot-and-mouth disease occurred in all but seven districts, the mortality being estimated at 1,373. The deaths were usually confined to young calves or old decrepit animals. Outbreaks of blackquarter were reported from 16 districts and caused a mortality of 700, as against 252 in the preceding year. Anthrax caused 1,109 deaths. 173 deaths were reported to have occurred from various other contagious diseases, including pleuro-pneumonia, tuberculosis, piroplasmosis, etc.

Pleuro-pneumonia occurred amongst sheep and goats to a very great extent in the district of Almora and destroyed 2,310 animals, while rabies, canine distemper, fowl cholera, and various diseases due to gross parasites accounted for deaths among the small domesticated animals.

The following table indicates the extent to which preventive inoculation was undertaken.

Name of disease against which inoculation was carried out	Method of inoculation followed	Number of outbreaks in which inoculation was undertaken	Number of animals which died uninoculated in course of outbreak		Number of animals inoculated		Number of animals which died after inoculation
			Bovines	Others	Bovines	Others	
Rinderpest . .	Serum alone	392	5,191	67	44,099	802	30
Haemorrhagic septicaemia	Serum alone	139	610	8	10,646	283	—
Haemorrhagic septicaemia	Vaccine	3	19	—	247	—	—
Blackquarter	Pillules	9	1	—	542	—	17

Details are also given with regard to cattle and horse breeding operations undertaken by the Department, the instruction of natives at Veterinary Colleges, and the organisation of the subordinate veterinary establishment.

BOOK REVIEW.

SMYTHE (R. Harrison), M.R.C.V.S., Civil Veterinary Surgeon, attached A.V.C.—**Wounds of Animals and their Treatment.**—xi + 194 pp. With 30 figs. 1918. London: Baillière, Tindall & Cox.

This small work contains much useful information based on up to date knowledge of the treatment of wounds in animals. The disinfection, dressing, process of healing, infection, and the various complications and sequelae of wounds are carefully described. The pages devoted to wounds of the head and neck, limbs and feet, "poll-evil," "fistulous withers," "quittor," and war wounds are very well written. Altogether, it is a handy volume, which can be commended for its many valuable details of wound treatment.

RECENT LITERATURE.

[Continued from this *Bulletin*, Vol. 5, No. 4, pp. 298-304].

PROTOZOAN PARASITES.

ARAGÃO (H. de B.). Espirochetose (Treponemose) das Gallinhas. [Fowl Spirochaetosis.]—*Rev. Vet. e Zootechnia*, 1917. Vol. 7. No. 1. pp. 3-10.

"Spirochaetosis in fowls, which is carried by the tick, *Argas persicus*, may be successfully treated by serum injections or organic arsenicals, such as atoxyl (0·03 grammes per kilo weight of the animal treated) or salvarsan (0·035 grammes). Prophylactic measures should include hygienic methods in the construction and upkeep of fowl-houses."—*Rev. App. Entom.* 1917. Dec. Vol. 5. Ser. B. Pt. 12, p. 190.

CHATTON (Edouard). Réalisation expérimentale chez le cobaye de l'amibiase intestinale à *Entamoeba dysenteria.* — *Bull. Soc. Path. Exot.* 1917. Nov. Vol. 10. No. 9. pp. 794-799. With 3 text-figs.

——. L'éclosion des kystes et les premiers stades de l'évolution de l'amibe dysentérique humaine chez le chat.—*Bull. Soc. Path. Exot.* 1917. Nov. Vol. 10. No. 9. pp. 834-841. With 9 text-figs.

COMMES (Ch.). Leucocytozoon et microfilaire d'un rapace diurne (*Astur badius,* var. *sphenurus*).—*Bull. Soc. Path. Exot.* 1918. Jan. Vol. 11. No. 1. pp. 31-34.

ESCOMEL (E.). Le *Phyllodactylus gerrhopygus* au Pérou. Son infection par une hémogrégarine.—*Bull. Soc. Path. Exot.* 1917. Dec. Vol. 10. No. 10. pp. 873-879. With 1 text-fig.

GALLI-VALERIO (B.). Observations sur *Eimeria zürni,* Rivolta.—*Schweizer Arch. f. Tierheilk.* 1918. Jan. Vol. 60. No. 1. pp. 7–17. With 1 text-fig.

HARTMANN (Max) & SCHILLING (Claus). Die pathogenen Protozoen und die durch sie verursachten Krankheiten, zugleich eine Einführung in die allgemeine Protozoenkunde. [The Pathogenic Protozoa and Diseases caused by them, with an Introduction into the Study of General Protozoology.]—462 pp. With 337 text-figs. 1917. Berlin: J. Springer. [Price. Mark 22. (bound Mark 24).]

LEGER (André) & LE GALLEN (R.). Etude expérimentale du pouvoir pathogène de *Spirochaeta crocidurae.*—*Bull. Soc. Path. Exot.* 1917. Oct. Vol. 10. No. 8. pp. 694–696.

LEGER (M.) & MOUZELS (P.). Hématozoaire endoglobulaire non pigmenté d'une Anatidée.—*Bull. Soc. Path. Exot.* 1917. Oct. Vol. 10. No. 8. pp. 699–700.

M'FADYEAN (J.). Coccidiosis in the Horse.—*Vet. Record.* 1918. Jan. 5. Vol. 30. No. 1539. p. 278.

In this letter the writer states that he was enabled to examine sections from the case of alleged coccidiosis referred to in the preceding number of this *Bulletin* (p. 298). He "was unable to detect any coccidia, or indeed anything remotely resembling coccidia."

MERCIER (L.) & MATHIS (C.) Kystes gamogoniques et schizogoniques chez *Entamoeba ranarum.*—*Bull. Soc. Path. Exot.* 1918. Jan. Vol. 11. No. 1. pp. 47–54. With 2 plates.

PONSELLE (A.). Déterminisme de la culture du trypanosome de la grenouille, *Trypanosoma rotatorium* Mayer, 1843. [Cultivation of the Frog Trypanosome.]—*C. R. Soc. Biol.* 1917. Nov. 10. Vol. 80. No. 17. pp. 824–826.

RHODESIA AGRICULTURAL JOURNAL. 1917. Oct. Vol. 14. No. 5. pp. 614–616. With 3 tables. African Coast Fever.

RODHAIN (J.) & VAN DEN BRANDEN (F.). Essais de transmission des parasites de la malaria à la roussette, *Cynonycteris straminea* (Note préliminiare).—*Bull. Soc. Path. Exot.* 1917. Oct. Vol. 10 No. 8. pp. 704–706.

SERGENT (Etienne). Sur un *Leucocytozoon* de la perdrix rouge d'Algérie (*Perdix rubra* Brisson.)—*Bull. Soc. Path. Exot.* 1917. Oct. Vol. 10. No. 8. pp. 701–702. With 1 text-fig.

STEVENSON (A. C.). The Presence of Trypanosomes in Brain Substance.—*Jl. Trop. Med. & Hyg.* 1918. Jan. 15. Vol. 21. No. 2. p. 17 With 1 plate comprising 6 figs.

TRIBONDEAU (L.). Recherche des hématozoaires sur préparations de sang à deux épaisseurs (nappe mince et tache épaisse). [Discovery of Haematozoa in Thin Films and Thick Layers of Blood.]—*C.R. Soc. Biol.* 1917. Dec. 22. Vol. 80. No. 20. pp. 942–945.

METAZOAN PARASITES.

Arthropods (Acari, Flies, Ticks).

BAKER (A. W.). Preliminary Notes on the Use of Repellents for Horn Flies and Stable Flies on Cattle.—*47th Ann. Rept. Entom. Soc. Ontario for 1916.* Toronto. 1917. pp. 52–56.

CHRISTY (Cuthbert.). Tsetse Flies and Fly-Belts.—*Ann. Trop. Med. & Hyg.* 1918. Jan. 31. Vol. 11. No. 3. pp. 279–282.

CROSS (H. E.). Experiments with Emulsions for protecting Camels against the Attacks of Blood-Sucking Flies.—*Agric. Res. Inst. Pusa.* 1917. Bull. No. 76. 11 pp. 1917. Calcutta: Superintendent Government Printing, India. [Price As. 2 or 3*d.*]

The preparations tried were kerosene oil emulsion, taramira (*Eruca sativa*) oil emulsion, an emulsion containing eucalyptus oil and turpentine, asafoetida solution, chirpine oil emulsion, creosol emulsion, Jensen's emulsion (which contains kerosene oil and powdered naphthaline), citronella oil. aniseed oil, cod liver oil, and castor oil. Conclusions: "Of the preparations used the only one that prevented Tabanidae from attacking for any length of time was castor oil, but it cannot be recommended on account of cost. None of the other preparations tried are of any practical value. As soon as the emulsions dry they have no repellent action against the flies."

HIRST (S.). Remarks on Certain Species of the Genus *Demodex*, Owen (the *Demodex* of Man, the Horse, Dog, Rat, and Mouse.)—*Ann. & Mag. Nat. Hist.* 1917. Sept. Vol. 20. No. 117. pp. 232–235.

MACGREGOR (Malcolm Evan). A Summary of our Knowledge of Insect Vectors of Disease.—*Bull. Entom. Res.* 1917. Dec. Vol. 8. Pt. 2. pp. 155–163. With 7 tables.

MARCHAND (Werner). An Improved Method of rearing Tabanid Larvae.—*Jl. Econom. Entom.* 1917. Oct. Vol. 10. No. 5. pp. 469–472.

MELANDER (A. L.) & SPULER (A.). The Dipterous Families SEPSIDAE and PIOPHILIDAE.—*Washington Agric. Expt. Sta.* 1917. Apr. Bull. No. 143. 97 pp. With 1 plate.

Railliet & Henry. Un nouveau foyer de gale sarcoptique (*Sarcoptes scabiei*) du lapin.—*Bull. Soc. Cent. Méd. Vét.* 1917. Nov. 8. *Rec. Méd. Vét.* 1917. Nov. 30. Vol. 93. No. 22. pp. 436–441.

Recueil de Médecine Vétérinaire. 1917. Dec. 15. Vol. 93. No. 23. pp. 653-655.—Conclusions d'un rapport de M. le vétérinaire principal Jacoulet, sur les essais pratiques de traitement de la gale des chevaux par les gaz sulfureux, selon le procédé du vétérinaire aide-major Lépinay. [Treatment of Mange in Horses by Means of Sulphur Gases.]

Snyder (T. E.). Notes on Horse-Flies as a Pest in Southern Florida.—*Proc. Entom. Soc.* Washington. 1916. Dec. Vol. 18. No. 4. pp. 208–211.

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BACTERIAL DISEASES.

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[The authors describe a small outbreak of poliomyelitis among dogs in a suburb of New York with lesions affecting the central nervous system corresponding with those observed in human poliomyelitis. From the cords and brains of the animals "a usually Gram-negative, pleomorphic bacillus was isolated." A young dog inoculated with cultures of this organism "developed typical symptoms (paraplegia and fever) and lesions."]

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TROPICAL DISEASES BUREAU.

TROPICAL VETERINARY BULLETIN.

VOL. 6.] 1918. [No. 2.

DISEASES DUE TO PROTOZOAN PARASITES.

TEICHMANN (Ernst). **Die Empfindlichkeit von Naganastämmen gegen Arsen und Antimon.** [The Sensitiveness of Nagana Strains to Arsenic and Antimony.]—*Biochem. Ztschr.* 1917. June 4. Vol. 81. No. 5–6. pp. 284–318. With 39 tables.

It has often been stated that all strains of trypanosomes are not equally sensitive towards the same drug; for example, trypanrot has a powerful effect on the trypanosome of mal de caderas, *T. equinum*, whereas it has only a feeble action on the nagana trypanosome, *T. brucei.* Also, atoxyl is a good remedy in infections with *T. gambiense*, whereas it has no action on *T. congolense.* In order to determine with certainty whether differences in sensitiveness towards a drug are exhibited by trypanosomes of the same species it is necessary to have for investigation the greatest possible amount of material for purposes of comparison and to carry out experiments under similar conditions. The author had available for his tests seven nagana strains; one of these was a West African strain preserved in rats and mice at the Hamburg Institute for Tropical Diseases since 1911, while the six other strains were brought to Europe in 1913 from German East Africa by BRAUN and Teichmann, and maintained at the Hygiene Institute of Frankfort.

The experiments detailed in this paper were performed on mice, towards which animals the strains varied greatly in virulence. The most virulent after an average incubation period of 2·10 days produced death in 3·95 days; on the other hand, in the case of two of the strains death was not produced until three or four weeks after inoculation, and remissions occurred in the course of the infections. Both the prophylactic and therapeutic action of the arsenic and antimony salts were tested. The course of the infections is carefully set out in the tables. The following are the author's conclusions:—

"The East African nagana strains examined can be clearly distinguished from one another as regards their sensitiveness towards arsacetin and these differences are brought forth whether the drug is used as a prophylactic or as a therapeutic agent.

"The West African strain maintained for a long while in European laboratories is almost insensitive to arsenic.

"This is equally true for infections arising from inoculation of single individuals as well as for such derivatives of these strains as have become fast against their antibodies.

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"Similarly the East African strains and the West African strain showed differences in sensitiveness towards potassium antimony tartrate.

"So far as duration of action is concerned, the prophylactic use of potassium antimony tartrate is capable of giving as satisfactory results as the therapeutic use of the drug according to the methods employed in these experiments.

"Arsacetin is a more effective curative agent than potassium antimony tartrate in the case of the East African nagana strains examined.

"Not every strain exhibits the same degree of sensitiveness to prophylactic and to therapeutic treatment with arsenic or with antimony.

"The virulence of the strains examined does not bear any relationship to their drug sensitiveness.

"Each of the strains considered exhibits a specific difference in its behaviour towards arsenic and antimony. Its sensitiveness, moreover, is not directed towards chemical influence in general; it must be specially determined for each single drug."

PONSELLE (A.). **Déterminisme de la culture du trypanosome de la grenouille, *Trypanosoma rotatorium* Mayer, 1843.** [Factors determining the Cultivation of the Frog Trypanosome.]—*C. R. Soc. Biol.* 1917. Nov. 10. Vol. 80. No. 17. pp. 824–826.

While studying bouillon blood medium, one of the most suitable for the cultivation of the frog trypanosome, it was found that the indispensable action of the broth (for it cannot be replaced by normal saline solution or ordinary water) was due not to its particular nutritive substances but to its acidity. The peptone broth usually employed in bacteriological laboratories and made slightly alkaline towards litmus is always acid towards phenolphthalin, especially after sterilisation. This acidity is due in great part to the presence of monobasic alkaline phosphates which are present in a high proportion in addition to the di-basic phosphates. It is the passage from a neutral medium such as blood to an acid medium which brings about in the frog trypanosome the series of divisions resulting in the so-called cultural forms.

By mixing one volume of infected frog blood with 10 volumes of an artificial broth made without meat and containing certain inorganic compounds, the flagellate cultural forms are obtained in less than 24 hours afterwards. In the absence of mono-potassium phosphate, or when this compound is replaced by the di-basic phosphate, the trypanosomes preserve their normal blood form without any tendency to cultural evolution. Peptone (1 per cent.), gelatine (0·5 per cent.), or even agar (0·1 per cent.) protects the cultural forms against the trypanolytic action of frog blood, probably owing to their absorbent power. This trypanolytic action of the blood is not directed against the normal blood forms but it appears to cause their destruction as soon as they begin to pass into cultural forms.

KRUMBHAAR (Edward B.). **Experimental Trypanosomiasis: *T. equiperdum* Infection in the Dog.**—*Jl. Infect. Dis.* 1918. Jan. Vol. 22. No. 1. pp. 34–42. With 2 tables & 5 charts.

The author's investigations were performed with the object of producing experimental haemolysis in dogs in order to study the relation of the spleen to blood destruction and regeneration. Chemical reagents employed for this purpose produced only a transient effect and thus *T. equiperdum*, the casual agent of dourine in horses, was employed. In this short article the author reports upon the morbid changes set up by these inoculations.

"At first, dogs were injected intraperitoneally with infected rat's blood containing approximately 600,000,000 *T. equiperdum*. As, however, infection did not always result, all subsequent inoculations were given intravenously and the procedure adopted of injecting 1 c.c. per kilo of body weight, of whole blood from a heavily infected dog, without further attention to the actual number of trypanosomes present.

"Such inoculations were successful in all instances except two: in one of these a second attempt proved successful, in the other, no further attempt was made. A few attempts to transmit the infection to guinea-pigs and rabbits were entirely unsuccessful. Our conclusions are based on the study of 28 infected dogs."

The author's observations are summarised as follows:—

"Dogs may be readily infected with *T. equiperdum* and a severe anemia be produced. The incubation period varies from 3 to 8 days, and a fatal termination results in from 3 to 7 weeks. By successive transmission through dogs the virulence of the infection may be increased so that both incubation period and duration of the disease may be shortened and the maximum anemia more quickly reached.

"With the appearance of trypanosomes in the circulating blood, the animals show general weakness, loss of weight, lethargy, and a lessened tendency to the healing of wounds. Subcutaneous edema is a common manifestation and may appear as a general anasarca or be limited to the genitalia or the extremities. The edema fluid contains living trypanosomes. Another interesting and almost constant lesion is keratitis. Choluria is constantly present without evidence of jaundice in the skin or mucous membrane.

"The anemia which develops is progressive and of the hemolytic type. The hemoglobin may fall to 40, and the red cells to less than 3,000,000 per c.c.

"Attempts at regeneration are shown by the increased number of skeined cells, occasional nucleated reds in the peripheral stream, and hyperplastic bone marrow at necropsy. That this attempt at repair is entirely inadequate, however, is shown not only by the progressive lowering of hemoglobin and erythrocyte count, but also by the leukopenia, diminution in platelets, later lowering of percentage of skeined cells, and disappearance of nucleated red blood cells from the peripheral blood stream.

"The principal pathologic changes are the usual degenerative lesions of anemia in the parenchymatous organs, hyperplasia of the bone marrow and a great enlargement of the spleen.

"Splenectomy at the height of the trypanosome infection has no beneficial influence, but rather the reverse, on the anemia or the course of the infection. Animals splenectomized before infection died more quickly than did those with intact spleen; as a rule, within 2 or 3 days after the appearance of trypanosomes in the circulating blood.

"The intravenous injection of arsenobenzol, 3 injections at intervals of 3 days, has been followed by a disappearance of all symptoms and of trypanosomes from the blood and of a prompt improvement in the blood picture. In some instances, however, the disease has recurred on the discontinuance of treatment."

WOODS (Alan C.) & MORRIS (Harold H.). **Complement Fixation in Experimental Trypanosomiasis.**—*Jl. Infect. Dis.* 1918. Jan. Vol. 22. No. 1. pp. 43–48. With 4 tables.

Summary. "Dogs infected with *T. equiperdum* develop complement fixation with a specific antigen within 8 days after inoculation. An easily prepared and a very satisfactory antigen is the salt solution extract of the spleen of a rat heavily infected with trypanosomes or dead from the infection. The complement fixation usually follows the appearance of trypanosomes in the blood, although it may occasionally precede the appearance of trypanosomes. The complement fixation, however, always antedates the appearance of symptoms.

"Dogs infected with trypanosomes frequently give a positive Wassermann reaction.

"Within 3 weeks after the appearance of trypanosomes in the blood, the serum of the infected dog becomes strongly anticomplementary. This anticomplementary phenomenon appears to be due to the liberation of anticomplementary substances into the blood by the invading trypanosomes.

"The blood is rendered sterile, and all clinical symptoms clear up following the intravenous injection of arsenobenzol, and in the only complete experiment at hand, the anticomplementary action and complement fixation properties with the trypanosome and Wassermann antigens likewise disappeared."

LAVERAN (A.) **Sur les leishmanioses expérimentales, et en particulier sur la leishmaniose canine, chez la souris blanche.** [Experimental Leishmaniasis, with Special Reference to the Effects of Canine Leishmaniasis on the White Mouse.]—*Bull. Soc. Path. Exot.* 1918. Mar. Vol. 11. No. 3. pp. 205-216.

In 1912 Laveran showed that the virus of kala azar was capable of producing in the white mouse visceral lesions bearing great resemblance to those observed in natural cases of the disease in man and since that date he has utilised this small rodent very considerably for the study of the various leishmaniases. In 1916 a culture of Leishmania which had been sub-cultivated 112 times in N N N medium and originally isolated from a natural case of infection in the dog was obtained from Tunis from Ch. NICOLLE, together with a dog which had been inoculated with virus from a bitch suffering acutely from the natural disease. It was found possible to infect white mice fairly easily by inoculating them intraperitoneally with the Leishmania obtained direct from dogs or from mice affected with leishmaniasis of canine origin. The infection was, on the other hand, difficult to set up by means of the cultures of these Leishmania. The infection, which ran a fairly chronic course, became localised principally in the liver and in the spleen.

On comparing these results with those obtained after inoculation with the viruses of the other leishmaniases the author draws the following conclusions:—

(1) The infection produced in the white mouse by the virus of natural canine leishmaniasis bears the greatest resemblance to the infection produced in this animal by the kala azar virus (Mediterranean or Indian). In both cases a visceral infection is produced, localised chiefly in the spleen and in the liver, and transmissible with difficulty by means of cultures of the Leishmania.

(2) In the case of male mice inoculated intraperitoneally with *L. tropica* (cultures or material obtained from the human subject or infected animals) one often observes after a certain interval in the testicular region swellings due to the multiplication in the testicles and surrounding connective tissue of large numbers of Leishmania, and these enlargements often become complicated with necrosis of

the overlying skin and oedematous swellings. If invasion of the internal organs takes place it is as a rule secondary in occurrence.

The fundamental differences between the infections due to *L. donovani* and those due to *L. tropica* in man, monkeys, and the dog as regards the seat of the lesions are less distinct in the case of the mouse. The cutaneous changes in the latter animal may become complicated with lesions in the internal organs or even be entirely absent.

HALL (Maurice C.) & WIGDOR (Meyer). **Canine Coccidiosis, with a Note Regarding Other Protozoan Parasites from the Dog.**—*Jl. Amer. Vet. Med. Assoc.* 1918. Apr. Vol. 53. (New Ser. Vol. 6.) No. 1. pp. 64–76. With 1 text-fig.

In a recent paper Hall (1907) described the occurrence of a coccidian parasite in 15 out of 200 dogs examined in Detroit, U.S.A. The parasite on further examination by the above authors is now concluded to be *Diplospora bigemina.* The coccidium showed a marked tendency to occur in adherent groups in the faeces. "Stiles (1892) notes that this species occurs in dogs and cats and in the polecat *Putorius putorius.* Railliet and Lucet (1891) have reported these as different varieties, *Coccidia bigeminum canis*, *Coccidia bigeminum cati*, and *Coccidia bigeminum putorii.* Weidman (1915) has reported another variety *C. bigeminum canivelocis* from swift foxes in the western United States" [see this *Bulletin,* Vol. 4, No. 1, p. 24]. "Stiles notes that the coccidia from the intestine of the dog which have been referred to by various authors as *Coccidium perforans*, the form from the rabbit intestine (regarded by some workers as identical with *Eimeria stiedae*), are probably *C. bigeminum.* Recently Guillebeau (1916) has reported *Eimeria stiedae*, the coccidium commonly found in the liver of rabbits, from the liver of dogs" [this *Bulletin,* Vol. 5, No. 1, p. 5], "but in his review of this paper Railliet concludes that the organisms described are not coccidia, but blastomycetes. Raillet does not regard the hepatic organisms described by Lieniaux, Clark, Marcone, or Olt as coccidia, and notes that forms described by Perroncito are trichosome eggs. He believes that *Diplospora bigemina* from the mucosa and sub-mucosa of the intestinal villi is the only coccidian known from the dog, and that while hepatic coccidia may occur in the dog no case of the sort has been established."

In the case of the material examined by the authors the oocysts measured 36 to 40μ long by 28 to 32μ wide. FANTHAM (1916) gives a range of 22–40 by 19–28μ for the oocyst of *D. bigemina.* These forms had two spores, each spore measuring 10 to 20μ in diameter, and each spore contained four sporozoites, each 12μ long by 4μ wide, and a residual body. In one animal a smaller strain of coccidia was found, the oocyst measuring 20 by 18μ, the spores 12 by 11μ, and the sporozoites 10 by 3μ.

Under favourable temperature conditions (22 to 29° C) the oocysts placed in 10 per cent. potassium bichromate solution appeared to develop infective sporozoites in two days. It was shown, however, that when the faeces were kept under less favourable conditions, resembling those found in nature, the process of sporulation might take two weeks or even longer. As a result of some feeding experiments it was found that from the time of the ingestion of oocysts containing infective sporozoites to the appearance of oocysts in the faeces of the dogs a period as short as three or four days to as long as 11 or 12 days might elapse; the oocysts then disappeared in all cases from the faeces in a few days except in one animal in which oocysts were present for 12 days. Repeated attempts to infect the latter animal subsequently failed, apparently showing that it had an acquired immunity to coccidiosis. On the other hand, CRAWLEY (1912) dealing with the self-elimination of coccidiosis stated that no immunity is produced in this disease and that another attack might result from a fresh infection from without. In the case of naturally infected dogs no apparent abnormality was discoverable in the digestive tract on post-mortem examination. However, when dogs were fed experimentally with large numbers of coccidia haemorrhagic conditions were stated to have been set up. The disease is said to be afebrile although the authors' experiments suggested that there was a slight elevation of temperature on the days during which oocysts were present in the faeces. Sometimes diarrhoea with the presence of gas and blood in the faeces appeared to be set up as the result of the coccidian infestation.

HADLEY (P. B.) i. **The Rôle of the Flagellated Protozoa in Infective Processes of the Intestines and Liver.**—*Rhode Island Stat. Bull. 166.* 1916. pp. 3–40. With 3 plates. [Extracted in *Exper. Stat. Rec.* 1917. Apr. Vol. 36. No. 5. pp. 483–484.]

ii. **The Avenue and Development of Tissue-Infection in Intestinal Trichomoniasis.**—*Ibid.* Bull. 168. pp. 3–64. With 11 plates & 2 text-figs. [Extracted in *Exper. Stat. Rec.* 1917. June. Vol. 36. No. 8. pp. 781–782.]

i. In 1895 Theobald SMITH figured as the cause of the so-called "blackhead" disease of turkeys an amoeba which he called *A. meleagridis.* Since that date several authors have taken up the study of this subject and many of them have attributed the disease either to a coccidian or to a flagellated parasite. Hadley's recent investigations detailed in the above two articles tend to incriminate as the etiological factor a flagellated protozoan, Trichomonas, which may be found not only in turkeys, but also in the intestines of all poultry as well as of most other animals. "In the intestines the flagellates are present in the cecal contents, but are found mostly in the mucous layer overlying the epithelium, and often deep in the crypts of Lieberkühn. Reproduction is by simple fission taking place mainly in the cecal content; also by encystation and spore formation, probably the common method of reproduction in the tissues. Ameboid forms are also encountered, especially in the tissues."

The following conclusions appear in the original article:—

> "The gross pathological picture includes congestion and enlargement of portions of the whole or part of one or both ceca, together with the presence of large, circular, yellowish, discrete or confluent, necrotic areas on the liver. These foci extend deep into the tissues. Frequently the ceca may contain a solid, cheesy or leathery, yellow or blood-stained core, composed of coagulated serum, fibrin, and cellular elements. The lumina are frequently quite obliterated. Fusions between the ceca and loops of the intestine, liver, or gizzard may sometimes occur; also between the liver and proventriculus.

"The microscopical pathological features involve the penetration of the epithelial wall by the parasites and a progressive infection of the subepithelial tissues, where the mode of reproduction is by encystation and spore formation. The result of rapid reproduction is great thickening of the cecal wall. In favorable specimens many of the features of flagellate morphology can be observed in the parasites located in these regions. The liver presents a corresponding appearance of the infecting elements, though more modified by their location.

"Very rarely the pathological condition may be complicated in the liver by an amebic infection (not *Amoeba meleagridis*) and in the ceca by both amebas and coccidia (*Eimeria avium*). The picture may also be complicated by infections with Hemoproteus.

"The nature of the infective process, together with extensive clinical experience, makes it clear that intestinal flagellatosis can not be regarded as an infectious disease, and that Trichomonas as found in these infections can not be looked upon as a pure parasite. A successful infection depends upon factors present in the host, and is probably quite unrelated to 'virulence' on the part of the infecting organism. In this sense the infection, commonly called 'blackhead' of turkeys, can not be regarded as an infectious or communicable disease.

"The parasitic flagellates here described are identical with some of the bodies earlier regarded by the writer as stages in the development of the coccidium, Eimeria. They are also identical with bodies described by Theobald Smith under the name *A. meleagridis*, of whose existence, as an ameba, up to the present time no conclusive evidence has been brought forward."

ii. In the second article Hadley reports upon the manner in which the flagellates responsible for the intestinal trichomoniasis penetrate the caecal epithelium and enter the sub-epithelial tissues, there to produce characteristic lesions, and describes the course of the infective process.

"As a result of a more or less fluid condition of the cecal content the flagellates multiply in vast numbers by autogamous reproduction and finally migrate into the crypts of Lieberkühn, where they tend to gather at the terminal branches and produce a marked bulging of the fundi.

"Either through pressure or natural invasive power, or both, the free motile flagellates (trophozoites) penetrate the goblet cells, force out the nucleus, or push it on one side, break through the base of the cell, subsequently through the basement membrane, and enter the connective tissue of the mucosa. A large number of flagellates may penetrate the same rift in the epithelial wall and subsequently become disseminated.

"With the further passage of flagellates through the epithelial wall they tend at first so to congregate as to separate the epithelial wall of the fundus from the basement membrane and from the core of the villus. The first mechanical effect upon the epithelial cells of the fundus is the production of a ragged, fringed appearance at the basement end.

"Either as a result of the mechanical damage brought about by the earliest of the invading flagellates or due to the effect of toxic metabolic products, the epithelial cells at the fundus of the crypts become further disorganised, permit other flagellates to pass, probably through intracellular rifts, and finally degenerate, leaving at the site of the fundus only free nuclei, cellular debris, and flagellates. Sometimes the epithelium of the fundus is pushed downward through the crypt-space without becoming fully disorganised.

"Through the subsequent migration of round cells and endothelial or other phagocytic cells into this region, the area (the crypt-space) becomes consolidated. At the same time many of the flagellates are surrounded by endothelial cells, while others proceed to invade further the core of the villus and the muscularis mucosae. The terminal portions of the epithelium usually remain intact at this stage.

"At this point the motile forms of the flagellates for the most part disappear and further multiplication in the tissues is continued by autogamous reproduction. At the beginning of this stage of development most of the parasites lose both the membrane and flagella, together with other organelles which characterise the trophozoite, and appear as the round or oval bodies, staining pink with eosin, which are regarded by Smith as amebas (*Amoeba meleagridis*).

"With the continued invasion of other crypts, followed by similar consolidations, the deep-lying cecal epithelium becomes parasitized, fusions with adjacent structures may occur, and secondary bacterial infections intervene. A secondary flagellate invasion of the ceca may occur through the outer serous covering as a result of contact-infection from the liver.

"With the further progress of the infection the parasites disseminate through the reticular tissues of the core of the villi and produce a sort of 'reverse infection,' attacking from the rear the epithelium overlying the terminal portions of the villi. With the gathering of parasites between the wall and the basement membrane the epithelium is first straightened and finally forced off. This is the culmination in the process leading to a more or less complete destruction of the cecal epithelium and a liberation of some of the parasites into the cecal canal.

"In explanation of the circumstances leading to the active invasion of the crypts, the data at present in hand makes it appear probable that an earlier diarrheal condition present in the lower intestine and ceca is mainly responsible for the great multiplication of the flagellates (autogamy) in the cecal canal and for the subsequent invasion of the crypts. It seems much less probable that the flagellates in themselves can be regarded as the cause of the initial diarrheal state. . . .

"True amebas, chiefly *A. intestinalis*, are frequently present in the ceca, sometimes in numbers, but only in exceptional cases can it be concluded that they are of pathogenic significance in the production of cecal lesions. Aside from those cases in which it is identical with the schizont stage of *Eimeria avium*, *A. meleagridis* must be regarded as the late trophozoite (rounded) stage of the intestinal flagellate, Trichomonas."

CHATTON (Edouard) & BLANC (Georges). **Notes et réflexions sur le toxoplasme et la toxoplasmose du Gondi** (*Toxoplasma gundii* Ch. NICOLLE et MANCEAUX 1909). [The Toxoplasm and Toxoplasmosis of the Gundi.]—*Arch. Inst. Pasteur de Tunis.* 1917. Oct. Vol. 10. Nos. 1 & 2. pp. 1-40. With 4 tables and 1 plate comprising 15 figs.

The gundi is a herbivorous rodent found on the borders of the Sahara Desert in Southern Tunis and living in the crevices among the rocks and ruins in the dry mountainous districts. It is used as a laboratory animal at the Pasteur Institute of Tunis and it was in this animal that the new genus of protozoa known as Toxoplasma was first discovered (1908) by CH. NICOLLE and MANCEAUX. Simultaneously the parasite was also described by SPLENDORE in the domestic rabbit in Brazil. Since that date toxoplasms have been identified in a number of other animals including the dog, a monkey, various rodents, several birds, and a snake in different parts of the world; also, special interest is attached to these organisms owing to the discovery by CASTELLANI (1913) of protozoa-like bodies very similar in appearance to them in a case of protracted fever and splenomegaly in the human subject in Ceylon. Hitherto attention has been chiefly devoted to the study of toxoplasmosis in the gundi, and since 1908 a number of observations on the subject have been made by CH. NICOLLE and his fellow workers at the Tunis Institute, and under his direction the above two authors undertook to continue the study under natural conditions. This study had been commenced by Miss PIXELL [see this *Bulletin*, 1914, Mar. Vol. 2, No. 1, p. 38].

The following is a summary of their observations and conclusions.

Among mammals the gundi is the animal in which toxoplasms have been most frequently and most constantly observed.

The disease is distinctly and regularly seasonal. The morbid season occurs during the coldest time of the year, that is from October to the end of February. In Brazil, in the case of the rabbit, toxoplasmosis shows the same peculiarity when account is taken of the inversion of the seasons (SPLENDORE).

Hitherto toxoplasmosis has only been discovered in gundis that have been kept at least 17 days in captivity at the Pasteur Institute of Tunis. Four hundred gundis were examined in order to determine whether the virus could be found in animals living under natural conditions but negative results only were obtained. These results, however, do not appear to be sufficient to enable one to assert that the gundis contract the disease at the Tunis Institute.

The natural ectoparasites of the gundi are the ticks *Rhipicephalus sanguineus* Latr. abundant especially in the nymphal stage, and *Hyalomma* sp. occasionally found in the nymphal stage; a mite *Trombidium* sp. abundant in the larval stage; a flea, *Coenopsylla mira* Rotsch. peculiar to the gundi and rarely found; two diurnal biting flies, viz., a Chironomid *Thersestes* (*Mycterotypus*) *laurae* Weiss and a Simuliid *Simulium liniatum*, and probably other nocturnal flies that bite man and other mammals in the neighbourhood of water also occasionally attack the gundi. Of these parasites only the Rhipicephalus and the mite seem possible carriers of toxoplasms in nature though neither these nor the other parasites mentioned breed on the gundi in captivity. As possible vectors in the laboratory *R. sanguineus*, of canine origin, *Dermanyssus* sp. from birds, *Ctenocephalus serraticeps* (dog flea) and *Cimex lectularius* (bed bug) should be considered.

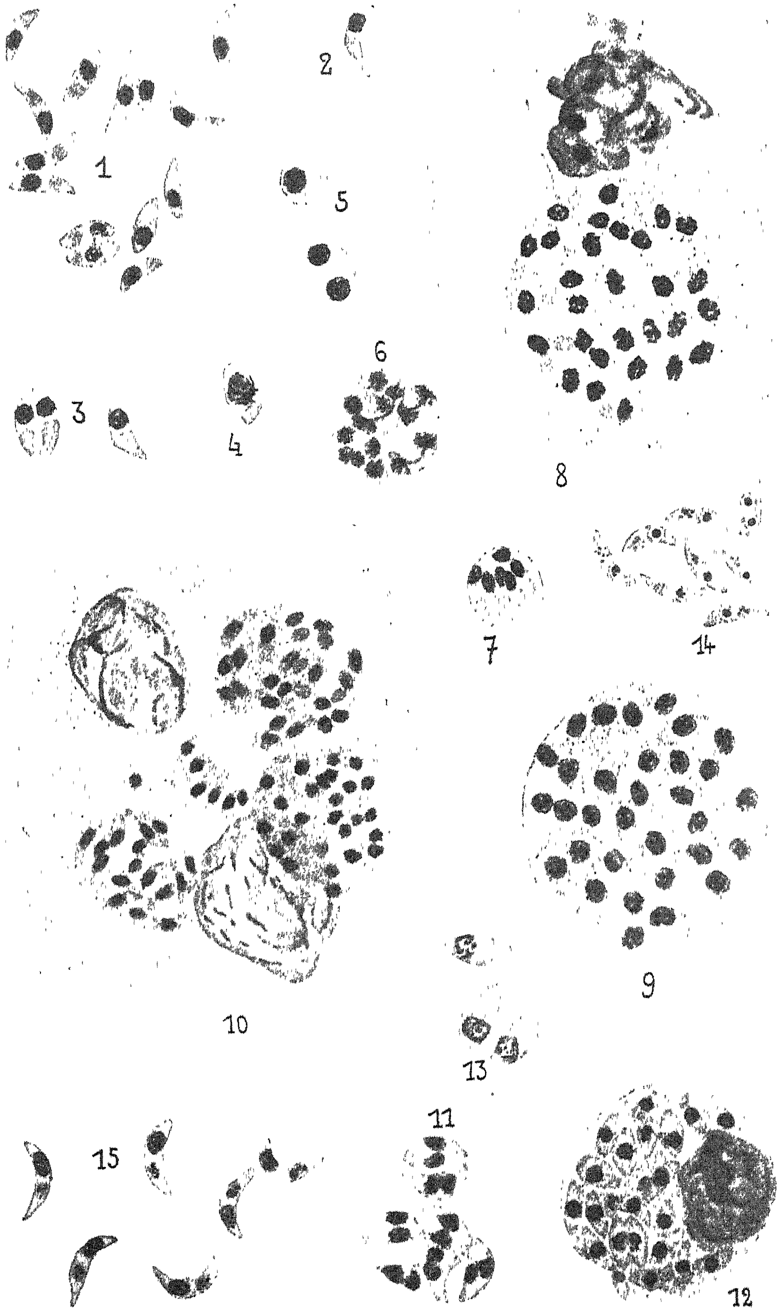
Two dogs, one in 1910 and the other in 1917, appeared to have contracted toxoplasmosis at the Pasteur Institute of Tunis where the kennel adjoined the gundi cage.

The gundi is apparently the most susceptible animal to its own virus. Intraperitoneal inoculation, which alone has been hitherto tried, sets up a fatal infection which runs its course in from four to 26 days. The reason for this difference in time is unknown. A fixed virus has been obtained capable of killing the gundi in four and a half days.

Where the disease runs a rapid course it is characterised by an abundant peritoneal exudation without manifest visceral lesions, thus differing from the natural disease. In cases where the disease develops slowly visceral lesions and enlargement of the liver and spleen are produced similar to those of the natural disease.

After the gundi the mouse is the most susceptible species (CH. NICOLLE & M. CONOR). The duration of the disease and its morbid anatomy depend on the channel of inoculation (MESNIL and SARRAILHÉ, SARRAILHÉ). Many other small rodents are susceptible to intraperitoneal inoculation. The white rat is resistant; the rabbit can rarely be infected except by intravenous inoculation and the dog can only be infected in this way (LAVERAN and MARRULLAZ). The cat is more susceptible than the dog; the receptivity of the pigeon is inconstant.

CHATTON (Edouard) & BLANC (Georges).] [*Trop. Vet. Bull.* Vol. 6. No. 2.



Toxoplasma gundii Ch. Nicolle & Manceaux in the gundi.

[Reproduced by permission from the *Archives de l'Institut Pasteur de Tunis.*]

It is hardly possible to differentiate between the different species of toxoplasms from the results of experimental infection. The difference in susceptibility of the various species of animals is very small; animals of the same species show a variable degree of susceptibility to the same virus and different strains of the same toxoplasm vary in virulence towards animals of the same species.

The characteristic form of the toxoplasm is the crescentic form showing different shaped poles, a single nucleus, no flagella, and a paranuclear secretory differentiation. It corresponds morphologically exactly with the rhabdogenetic form of DELAGE and HÉROUARD, characteristic of the true sporozoa.

There appear to be two methods of multiplication viz., (1) binary longitudinal division (tomogony) of the crescents (tomonts) which takes place especially in the lymphatic cells, and, (2) occasionally schizogony, which takes place in the fixed visceral cells.

The schizogony is of the coccidian type and this phenomenon together with the rhabdogenetic structural type of the crescent places the toxoplasms undoubtedly among the sporozoa.

On the other hand the tomogony, which is absolutely exceptional in sporozoa (Babesia), is a very remarkable character which the toxoplasms appear to have maintained from their flagellate ancestors.

Briefly the toxoplasms should be ranked among the sporozoa in close proximity to the coccidia, and should probably be considered on account of their longitudinal division as more nearly related to the flagellate source, which is now generally attributed to all rhabdogenetic sporozoa.

The failure to cultivate toxoplasms on artificial media is attributable to their sporozoan nature.

See figures on opposite page.

In part taken from the preparations of CH. NICOLLE. All the figures are magnified 1,750 diameters. The differences in size and form of the crescentic elements are accounted for by the different degrees of desiccation and spreading of the smears before fixation.

1. Isolated tomonts; normal form and dimensions. The fusiform elements must be considered as forms about to undergo fission, paranuclear area more or less visible. Experimental toxoplasmosis; ascitic fluid (osmic acid vapour, normal fixation, Giemsa).

2. Tomont with elongated posterior pole and well differentiated paranuclear area. Natural toxoplasmosis; lung (osmic acid vapour, normal fixation, Giemsa).

3–4. Isolated tomonts of the same type, one dividing form and the other two produced by fission. Natural toxoplasmosis; lung (osmic acid vapour, Giemsa).

5. Young schizonts, with one or two nuclei. Natural toxoplasmosis; liver (alcohol, Giemsa).

6. Schizont in more advanced stage, the nuclei dividing (haplomitosis). Natural toxoplasmosis; liver (alcohol, Giemsa).

7. Small-sized ripe schizont with schizozoites arranged in barrel fashion. Natural toxoplasmosis; liver (alcohol, Giemsa).

8. Large-sized unripe schizont enclosed in a crushed pulmonary cell. The paranuclear areas of the schizozoites are differentiated. Natural toxoplasmosis (osmic acid vapour, Giemsa).

9. Ripe schizont extracted from its host cell. Natural toxoplasmosis; liver (alcohol, Giemsa).

10. A group of schizonts in different stages within a binucleate crushed pulmonary cell. Natural toxoplasmosis (osmic acid vapour, superfixation, Giemsa).

11. Group of bi-nucleated tomonts in process of fission. Natural toxoplasmosis; liver (alcohol, Giemsa).

12. A pseudo-schizont or mass of tomonts resulting from fissiparous divisions within a mononuclear leucocyte. Experimental toxoplasmosis; ascitic fluid (osmic acid vapour, slight superfixation, Giemsa).

13. Tomonts distorted by desiccation. Artificially produced ovoid form. Experimental toxoplasmosis; ascitic fluid (osmic acid vapour, insufficient fixation, Giemsa).

14. Tomonts fixed in the wet state with Bouin-Duboscq's fluid and stained with iron-haematoxylin. True structure. Experimental toxoplasmosis in the mouse with *T. gundii*.

15. Group of eimerian schizozoites in a smear from a fragment of intestinal mucous membrane from a cat affected with coccidiosis (due to *Eimeria* nov. sp.) to illustrate the coccidian form and structure of the tomonts and schizozoites of Toxoplasma (osmic acid vapour, Giemsa).

DISEASES DUE TO METAZOAN PARASITES.

SIMPSON (James J.). **Bionomics of Tsetse and Other Parasitological Notes in the Gold Coast.**—*Bull. Entom. Res.* 1918. Feb. Vol. 8. Pts. 3 & 4. pp. 193–214.

This report is based on observations made from Sept. 1915 to Feb. 1917 in an area lying partly in the Northern Territories of the Gold Coast, partly in Togoland, and drained by the River Volta. It extended from 8° N. to 9° 45′ N and from 0° 15′ E to 2° 30′ W. A report dealing with the vegetation of this region has already been given by the author in 1914 [see this *Bulletin*, Vol. 2, No. 3, p. 148].

Dealing with the factors influencing the distribution and prevalence of tsetse the author mentions that several writers on this question in West Africa refer to "fly belts." However, according to the author's experience in that territory, he has no knowledge of any definite locality, either in the wet or dry season, containing tsetse actually cut off from the surrounding country. "To a casual observer this might appear to be so, but if the immediate country be thoroughly examined, it will be found that tsetse exist linking up these so-called belts, though undoubtedly in smaller numbers." "At the end of the dry season (December to February in West Africa), when the forest fires are raging, tsetse (along with game) are undoubtedly driven before them and take refuge in the denser bush unattacked by such fires, but the pupae are seldom damaged and soon repopulate the area burnt, in addition to the adults which return after a short time." Thus, "in the Northern Territories of the Gold Coast there is hardly a square mile where tsetse cannot be captured at some period of the year. This is extremely important in the case of horse transport. In these Territories certain areas are 'proclaimed' for horses, but this precaution only leads to a false security. There is no road between any two stations in the Northern Territories free from tsetse, and as it is not the actual number of flies, but the proportion infected that counts, such a regulation is worse than useless."

With regard to the influence exerted by the type of vegetation the author's observations indicate that *Glossina palpalis* is found along the banks of rivers where vegetation is dense, in "kurimis" (dense bush with abundant shade), and along the banks of the smaller tributaries. *G. tachinoides* is an up-country form allied to *G. palpalis*, and is found in similar localities on the higher reaches of the rivers. *G. submorsitans* is seldom found near rivers and is more abundant in the savannah forest and open savannah country; the species was found at least three miles from the nearest water. In very open country where small water holes exist, *G. submorsitans* is more frequent, but this may be, and probably is, because game comes to water there. *G. submorsitans* will, however, follow a herd of game a long distance, and undoubtedly migrates in this manner.

The author quotes LLOYD's statement that a small proportion of females and a large number of pupae may be collected where game is plentiful. This is also borne out in West Africa. When game is abundant the females manage to feed easily and when fully engorged retire to the seclusion of some shady place; they are also able to propagate more rapidly, consequently the number of pupae is increased. All over the Northern Territories the close association between *G. submorsitans* and game, and especially the dog-faced baboon, is very marked.

Humidity appears to be the prevailing factor influencing the numbers of tsetse. At the beginning of the dry season these insects increase greatly in numbers. Whereas actual sunshine only affects the daily period of activity, a hot sun most strongly affects *G. palpalis*, which seldom follows one in direct sunlight. *G. tachinoides* is next affected, whereas *G. submorsitans* will follow and attack in the open in the hottest sun, but seldom at night. ROUBAUD states that *G. morsitans* when exposed to a temperature of 40° C (104° F) died within an hour. This was not found to be the case in the Northern Territories. The flies were frequently caught in the open at a time when the temperature was from 109° to 112° F. For this reason, when cattle, horses, and other animals have to be transferred from one place to another, this should be done if possible during the night.

An account of a new variety *G. palpalis* var. *pallida* is next given.

Dealing with the food of Glossina the author quotes numerous observations of his own and other authors showing the percentage of mammalian and non-mammalian blood found imbibed in these flies. These proportions vary considerably in different observations, but it appears that *G. morsitans* is much more dependent on mammalian blood than is *G. palpalis*. A considerable number of *G. tachinoides* were examined by the author whose figures are, in the case of that fly, mammalian 67·3 per cent., non-mammalian 32·7 per cent. The source of the non-mammalian blood seems to be mainly reptilian. The flies were found to gorge themselves repeatedly on certain reptiles kept in captivity whereas they could not manage to obtain a full meal from birds unless these animals were tied down. The chief source of mammalian blood for *G. tachinoides* appears to be a large yellowish-brown bat which sleeps during the day in a suspended position in the dense overhanging trees in localities where the flies abound. No tsetse were ever found to imbibe water or seen to drink an exposed liquid. Attempts were made to feed the flies on liquids covered with a membrane composed of rats' skin and on various fruits but in no case was any liquid ever imbibed except fresh blood. The percentage of mammalian blood to non-mammalian blood differs greatly in the case of *G. submorsitans.* Only 2·3 per cent. were found to contain nucleated blood corpuscles and this would be accounted for by the fact that the fly abounds in open country away from water where there is practically no reptilian fauna. Tsetse were never seen to imbibe fresh blood from the open wounds of shot animals but always pierced the skin to imbibe blood.

The question concerning the disparity in the proportion of sexes in Glossina has attracted the attention of many observers in various parts of Africa. After quoting some statistics given by other observers the author details a number of figures showing the percentages of sexes caught at various seasons of the year together with the rainfall during those periods. As at certain times *G. tachinoides* predominated in the areas visited and at other times *G. morsitans* predominated the author was unable to make a consecutive study of either. Judging from the data set forth in the case of *G. tachinoides,* the one outstanding feature exhibited by these figures is stated to be that the percentage of males decreases as the rains gain in intensity and the humidity increases; i.e., the percentage was found to decrease from between 60 and 70 down to just under 50 under those conditions. A much greater disparity in the proportion of the sexes was found in *G. submorsitans.* The general average worked out at from 90 to 95 per cent. of males but there were certain discrepancies, e.g., in June at one place the percentage was only 46, while in August it was 85.

Some interesting experiments were made in order to determine the distances Glossina might travel. A certain number of marked *G. tachinoides* were liberated from various points on a road alongside which ran two small streams. The experiments were carried out during the wet season and during the dry season. During the latter season there was no water in the streams, but they contained a considerable quantity of water during the wet season. The flies were liberated at night and were fed before they were allowed to escape. From these experiments it was found that a few rare specimens were capable of covering a maximum distance of four miles, and that the great majority did not return over a greater distance than two miles. All seemed to return to the water as none were caught at a greater distance from the river than the point from which they were liberated. If there was any intermediate water between the place where the tsetse were liberated and the large river the tsetse discovered this and were making their way down stream to the large river. Where there was a shade on the bank of a stream, but no water, the tsetse congregated there and did not attempt to proceed towards the large river. A thorough examination of the open bush on each side of the road revealed not a single tsetse at a greater distance than 200 yards. There was practically no discrepancy in the proportion of the sexes re-captured. It was found impracticable to perform similar experiments in the open bush. On another occasion numbers of tsetse were liberated along the bank of the river. The greatest distance covered by a single tsetse was seven miles while numerous flights of two to four miles were observed. It was most probable, however, that these had followed the numerous canoes plying constantly on the river.

Ten experiments were performed in order to ascertain how far tsetse would follow a herd of game. In half of these tests the flies were disturbed continuously with fly switches, while in the other half they were not molested. In both sets of experiments it was found that after five miles had been traversed the tsetse (*G. submorsitans*) either had all managed to feed or had given up the attempt and disappeared.

The problem of how to devise measures for the diminution of tsetse in a given area is of very considerable importance. It has been repeatedly shown that in the case of villages a clearing of about 400 yards around their outer circumference will practically restrict the tsetse to a region outside this area. This clearing must, however, be kept up continuously; otherwise the scrubby vegetation which later appears proves very suitable for the flies. These measures can also be applied to the fords of rivers and the main roads in a district.

In a restricted area such as, for example, the Island of Principe, systematic trapping has had very beneficial results. In wide areas, such as any of the colonies of West Africa the conditions are totally different; for example, along a portion of the River Volta examined the author found that there was not one half-mile in the whole area where *G. tachinoides* was not present in abundance. Five experienced men were posted for four months alongside a ferry across this river for the purpose of ascertaining whether by systematic trapping a diminution in the number of tsetse would be brought about at the end of that time. No reduction in numbers was, however, effected.

Systematic trapping with bird lime was found to be less satisfactory than by means of nets. Four colours of paper were used, light brown, red, black waterproof, and green. The following were the average number captured daily in these nets, five men being used for each colour :—Light brown 103, red 89, black waterproof 79, green 45.

The author then tried liberating tsetse in a closed room and smearing the bodies of collectors with the following oils and essences :—oil of bergamot, oil of cloves, beechwood oil, oil of lavender, cedar wood oil, beechwood creosote, essence of orange, and essence of lemon. The tsetse were allowed to alight on and bite the collectors, and only in two cases did the substances seem to act as deterrents, viz., in the cases of beechwood creosote and beechwood oil. In the case of oil of cloves and the two essences there seemed to be a marked attraction.

The conservation and increase in the numbers of the natural enemies of tsetse is a subject of importance. Guinea-fowl and bush-fowl have been mentioned by some writers. However, the author examined the stomach contents of 379 of these birds but in no case did he see any remains of either adult tsetse or pupae. An examination of the stomach contents of lizards revealed numerous kinds of insects but never of tsetse. The same was true of the nests of mason wasps. Tsetse are not "fleshy" insects, and are therefore unsuitable as a food for growing larvae. Some carnivorous spiders and dragon flies have been observed to devour tsetse. By far the most important insect enemies of tsetse are asilid flies and wasps of the genus Bembex. The toll of tsetse, of the species *G. tachinoides*, taken by Asilidae is considerable. They follow cattle and horses long distances and the author on many occasions observed an asilid grasp a tsetse about to alight on a horse's neck. Sometimes they would hold a fly on a twig for over a quarter of an hour, occasionally shifting the position of the proboscis, which was inserted into the thorax of the tsetse. Of

24 tsetse put in a mosquito net with six Asilidae all were dead within 24 hours, and all showed signs of having been punctured. Bembex is the most voracious enemy of *G. submorsitans*; it does not alight but darts quickly down and either captures the tsetse on the wing or immediately it has alighted.

The author then deals with the breeding places and habits of Glossina. In the case of *G. tachinoides* reared in the laboratory it was found that the longest time taken by a pupae to hatch was 49 days while the shortest time was 22 days. From the pupae deposited in September only 41 per cent. reached maturity while of those deposited in November 87 per cent. produced adults. Males and females appeared in practically equal numbers but the males died off more quickly than the females. The mortality amongst the males was 35 per cent., amongst the females only 17 per cent.; these figures refer to those which died before taking a meal. 447 pupae of the above fly were collected from the banks of the river in January and February and of these 392 produced adults. The most common situation for the pupae of *G. tachinoides* is in the decayed humus beneath overhanging trees in places which are quite sheltered from heavy rains and are moistened only occasionally by water dripping down and are protected from the sun. No breeding places were found amongst tall grass although adults are very abundant in this material. The principal breeding season of the fly appears to be just after the dry season, when the rains commence, and at the end of the rainy season breeding practically ceases.

The breeding places of *G. submorsitans* are very similar to those of *G. tachinoides* with the exception that on several occasions pupae were found on the clusters of small growth on the top of deserted anthills. The pupae of the *submorsitans* were never found in the burrows of porcupines nor in those of bush-pig and wart-hog as stated by LLOYD. Out of 947 pupae of this fly collected 821 adults emerged (402 males, 419 females); 124 of these died before feeding, the males dying off much more quickly than the females. Intra-uterine pupation was observed on four separate occasions.

The author concludes his observations on Glossina by a few remarks on the parasites of the pupae. Up to the present time no such parasites have been described from West Africa. As, however, there is no hope of exterminating or even diminishing of numbers of tsetse by trapping or other methods of destruction in that territory the author states that our only hope lies in the direction of systematic breeding of parasites and their dissemination in fly-infested areas. Investigations carried out over a considerable period showed that a small proportion of the pupal of *G. tachinoides* was parasitised by *Chalcis amenocles* Walk., which was the only parasite found. From the pupae and empty pupae cases of *G. submorsitans* the author also bred out the above species of parasite and in addition four other species of parasites. The author was able to breed *C. amenocles* in large numbers on the larvae and pupae of Sarcophaga and as species of these insects are abundant around villages it should be possible in a very short time to obtain large numbers of parasites for dissemination.

A short account of the fauna of the Northern Territories is given and a considerable time was spent in the game area to find out what kinds of game harboured parasites. *Trypanosoma pecorum* was found in the blood of two wart-hog and *T. vivax* in two reed buck. The blood of a haartebeest and of a red-flanked duiker contained a piroplasm resembling *Theileria parva*. The prevailing tsetse of the district, *G. tachinoides*, according to various authors, carries *T. brucei* in its natural state in West Africa. *T. pecorum* was common in cattle and was also found in horses, while one of the author's ponies died of an infection with *T. vivax*. It is rather strange that no specimens of *T. congolense* were found in the blood of game as a large number of the cattle and horse examined were infected with this species. The paper concludes with a list of blood-sucking flies, other than Glossina, and ticks, together with their hosts, found in the area under investigation.

CHRISTY (Cuthbert). **Tsetse Flies and Fly-Belts.**—*Ann. Trop Med. & Parasit.* 1918. Jan. 31. Vol. 11. No. 3. pp. 279–282.

Species of Glossina belonging to the *morsitans* group are rarely to be found outside certain areas known as " fly-belts." The fly migrates *en masse* from one part of the belt to another but no one seems yet to have afforded a satisfactory explanation why it should migrate within certain limits ; the country beyond the fly-belt is often identical in character and type of vegetation but the fly is seldom observed outside the belt even in pursuit of animals. There are two forms of migration within a belt ; one due to the burning of the bush in the dry season when the fly retires to the shelter afforded by streams and moist places while the other, in which the flies seem to have certain months of migration, is more difficult to understand. The author is convinced that animals play a very small part in this latter form of migration. He has observed flies swarming around herds of buffaloes at a certain time while a week later not a single fly could be seen on the same herd. On several occasions areas of country were found swarming with fly but containing very few animals to serve apparently as hosts. Such districts are to be found in the Eastern Welle basin and in the Bahr-el-Ghazal. The presence or absence of game depends upon grazing facilities, but these have no relation to the presence or absence of fly ; also the prevalence of sleeping sickness has no relation to the number of *morsitans* or to the number of game in these districts. The author considers it is a dangerous assumption to conclude that wild animals are the chief reservoir of the trypanosome of sleeping sickness. He is convinced that the antelopes play a quite negligible part. Pigs, in his opinion, especially the common red river-hog and the wart-hog as well as the semi-domesticated pig, are probably the most dangerous animals. The possibility of exterminating all the wild animals in any part of Tropical Africa is considered quite impracticable, and such a measure would probably have very little effect in eliminating sleeping sickness. In the districts above referred to the blood of 160 wild animals was examined and only in 5 of these were trypanosomes found. Only in the case of one animal, a wart hog, was a trypanosome found resembling the sleeping sickness trypanosome. Three of the animals were infected with a short active trypanosome of the *pecorum* type, while in the fifth a long thin trypanosome was observed. No trypanosomes were found in buffaloes.

Bedford (G. A. H.). The Spinose Ear Tick (*Ornithodoros megnini* **Dugès**).—*Union of South Africa. Dept. of Agric. Local Series No. 18.* 1917. July 12. 6 pp.

Reference is made to the above tick and the conditions set up by it in the appendix furnished by the Director of Veterinary Research in the Report of the Department of Agriculture. Union of South Africa, for the year 1916 [see this *Bulletin*, Vol. 6, No. 1, p. 59].

The tick is stated to be a native of South America and was probably introduced into South Africa with imported stock. The date of its first introduction is not known. It was first identified by Theiler at Vryburg in 1912, but it appears to have been observed in Cape Colony as far back as 1898. During the last few years it has become extremely common and widely distributed throughout the Cape Province, Orange Free State, and Bechuanaland, but to a far less extent in Natal. The ticks seem to be only found in districts where the rainfall is very low and even in these districts they appear to become less numerous after heavy rains.

The ticks chiefly infest the ears of cattle, sheep, and goats and more rarely they are to be found in the ears of horses, donkeys, dogs, cats, ostriches, and occasionally in man. Unlike all other ticks they are only found in the ears of their hosts and occasionally penetrate into the auditory meatus. The fluid injected by the ticks into their hosts while feeding causes great irritation and badly infected animals lose appetite and condition. Calves, sheep and goats have been known to succumb when severely infected. The ticks are not known to be able to transmit any disease.

The ticks belong to the family *Argasidae*, easily distinguished from the family *Ixodidae* (which includes the majority of ticks) by the entire absence of a dorsal shield or hard plate, which in the Ixodidae entirely covers the dorsal surface of the body of the male, and forms a small round plate just behind the head in the female.

"In general appearance they much resemble the Fowl Tick (*Argas persicus*, Oken) and the Tampan (*Ornithodoros moubata*, Murray). From the former they can easily be distinguished by their shape, and from the latter by the integument, which is pitted in *O. megnini*, and mammillated (covered with small pimples) in *O. moubata*.

"The *adults* are fiddle-shaped, brown or slate in colour, and their surface is pitted with small circular holes. The head is situated in front of the ventral surface ; eyes absent ; legs yellow.

"The males resemble the females, but are slightly smaller in size.

"The *nymphae* when engorged resemble the adults in shape and colour, but can at once be distinguished by the surface of their bodies, which are covered with small outstanding spines ; these spines can be easily seen with the aid of a pocket-lens.

"The larvae when unengorged are extremely small, white in colour, and have only three pairs of legs, whereas the nymphae and adults always have four pairs of legs. After engorging they become swollen, white or red in colour, and their legs and head can only be seen when examined under a microscope. These engorged larvae are unable to move, and are often mistaken by the farmers for eggs.

"The *eggs*, like the eggs of other species of ticks, are extremely small, oval in shape, and reddish brown in colour.

"The life history. The female ticks lay their eggs under stones on the veld, in cracks and crevices of trees, gates, or walls, or on any other place where they can get sheltered from the sun. These eggs hatch out in about 22 to 56 days, and give rise to six-legged larvae, which as soon as they have hatched, crawl about in search of a host, and as soon as they find one they get into its ears and there commence to feed. The longest time the larvae are able to live without food is about 2 to 4 months. After engorging, which takes about 5 to 7 days, they become quiescent, and are then unable to move until they have cast their skins and become nymphae. The length of time the nymphae remain on their host varies considerably. The shortest time in which they can engorge themselves appears to be about a week, but may be considerably prolonged in some cases. Hooker has observed a nympha to abandon its host's ear 35 days after the larva had been introduced, and in other cases a nympha remained attached after 98 days had elapsed. Nymphae have also been observed at Onderstepoort to remain in the ears of their hosts for three months. When engorged they leave their host and crawl about in search of some sheltered spot where they can change into adults, which takes from 7 to 31 days.

"They then fertilise, and then the females commence laying eggs, after which they die.

"It is not necessary for the adults to nourish themselves before copulating and ovipositing, as they are able to store up enough food in the nymphal stage. Engorged nymphae collected from the ears of their hosts in November, 1916, and kept in the Laboratory in wooden boxes moulted into adults in 7 to 9 days. A number of them died about 2 to 5 months after they were removed from their hosts, whilst others, including a male which fertilised a female soon after it had moulted into an adult, still remained alive after six months.

"Mégnin states that he has kept some *O. megnini* alive for two years without food."

With regard to measures for eradicating the ticks the most satisfactory methods to be employed are as follows :—

(1) The ticks may be destroyed on their hosts by pouring some insecticidal liquid into the affected ears ; the best preparation is made up of 2 parts each of Stockholm tar and oil to 1 part of turpentine ; from a teaspoonful to a tablespoonful is poured into each ear according to the size of animal to be treated, the mixture being well stirred before use. On badly infected farms it may be found necessary to treat the animals' ears every two or three weeks or even every week ; otherwise, they need only be treated once every month. Infected animals should be treated before removal from one farm to another.

(2) Preventive treatment may consist in either not keeping animals in kraals or in keeping them in non-infected kraals. The kraals generally in use, especially those made of stone and earth or cow-dung bricks, afford excellent breeding places for the ticks and are practically incapable of disinfection. In exceptional cases the interval between the nymphae of one generation leaving their hosts and the young larvae of the next generation may be quite two years, and thus infected kraals should be closed for at least that period. The animals may then be removed to kraals surrounded by a wire fence. Brushwood may be placed round the enclosure stacked up against the fencing to act as a protection against wind and rain. Such temporary enclosures can be easily taken down and removed from one part of a farm to another as it is not advisable to keep stock herded closely together on a small area too long.

According to the author it is strongly advisable not to keep the animals in kraals unless it is absolutely necessary but to turn them out on to the veld. In some parts of South Africa, however, it is not safe to leave sheep and goats on the veld at night on account of jackals. In this case they should be kept during the night in the tick-free enclosures referred to above.

RANSOM (B. H.). **Recent Progress in the Development of Methods for the Control and Treatment of Parasites of Live Stock.**—Paper presented before the Second Pan American Scientific Congress, Washington, U. S. A. Dec. 27, 1915–Jan. 8, 1916. 10 pp. 1917. Washington: Government Printing Office.

This paper is of interest inasmuch as the methods that have been employed for the eradication of the gross animal parasites in the United States are briefly reviewed and the possibilities of further success based on our present knowledge of the life histories of the parasites are discussed. The above measures are dealt with in the United States of America by a special section (the Zoological Division) of the Bureau of Animal Industry, and this section is under the control of the author.

As an indication of the work accomplished in that country by rational measures of control and treatment the following extract may be quoted:—

"The possibility of eradicating the Texas fever tick (*Margaropus annulatus*) became evident nearly a quarter of a century ago, when the principal facts in its life history were established, and somewhat later Curtice, Butler, and others furnished practical demonstrations by eradicating ticks from certain localities. It was not until 1906, however, that tick eradication was taken up in earnest on a large scale in the United States. The result of a little more than eight years work up to January 1, 1915, has been the release of about 225,000 square miles of formerly tick-infested territory from quarantine, nearly one-third the original quarantine area of about 730,000 square miles.

"Leaving out of consideration the question of improvements in administration, organisation, etc., the most important change in methods of tick eradication since the beginning of the undertaking has been the adoption of the arsenical dip as an agent for the destruction of ticks. Other remedies had for one reason or another proved partial or complete failures, but the arsenical dip after a number of modifications was found to be very satisfactory, and since it has come into general use eradication has progressed by leaps and bounds. Portable testing outfits for the rapid determination in the field of the percentage of arsenic in dipping baths have been recently devised, and have proved very useful in tick eradication work (Chapin 1914).

"The spontaneous oxidation and reduction of arsenical dipping baths reported by Fuller (1911) and others are phenomena of considerable practical importance as there is a difference in the efficacy of oxidised and unoxidised arsenical baths. For example, a bath containing originally a certain amount of arsenic in the form of sodium arsenite, may become more or less oxidised, with transformation of more or less of the sodium arsenite into sodium arsenate, which is less efficacious against ticks. Consequently, this bath might then fail to destroy ticks upon the cattle dipped in it. The field test, however, which shows the amount of arsenic present in the arsenite form, makes it possible to determine readily whether a given bath is up to standard in so far as the percentage of arsenite is concerned. Another question arises, whether a bath low in arsenite can be strengthened by adding enough fresh concentrated dip to bring it up to standard, without at the same time increasing the total amount of arsenic (arsenite+arsenate) to a point where it is dangerous to cattle. Recent experimental work has indicated that strengthening the bath in this manner may be done without injury to the cattle, even though the total amount of arsenic is raised much higher than it is ever likely to be in practice. The field test thus makes it possible to use the same dipping bath repeatedly, with the assurance that it will be at the proper strength each time it is used, more arsenic or more water being added according as the test shows the percentage of arsenic to be too low or too high.

"Comparatively little new has been added recently to our methods of handling scabies. Field-testing outfits for lime-sulphur and nicotine dipping baths, the two most efficacious remedies for scabies of cattle and sheep, promise to be as useful as the testing outfit for arsenical baths (Chapin, 1915). In connection with sheep scab it is of interest to note that Wolffhügel (1913) has called attention to the occasional persistence of scab mites in the ear and infraorbital groove of sheep which have been dipped, and has suggested that many failures to cure scab may be traced to this circumstance."

Other conditions such as those caused by warble flies (*Hypoderma bovis* and *H. lineatum*), *Dermatobia noxialis*, and the screw worm (*Chrysomyia macellaria*) which may also be controlled by the application of arsenical dips are considered.

Dealing with helminth infestations the author does not hold forth much hope of evolving a satisfactory method for controlling by preventive measures the serious losses caused by stomach worms (chiefly *Haemonchus contortus*) in sheep. Many of the details of the life history of these worms have been determined. The eggs of the parasites during the summer months hatch in a few hours and the larvae develop to the infectious stage within a week after the eggs are dropped on the pasture In this stage they are very resistent, and may be frozen repeatedly and kept in a dried condition for long periods of time without losing their vitality. A field vacated for seven months, from October to June, was found still to contain living larvae when tested by placing non-infected lambs in it. The adult worms may live many months in the stomach of their host and have been found still present in small numbers in sheep kept a year and a half on a board floor and handled in such a manner that the chance of fresh infection was reduced to a minimum.

" In view of the various difficulties that stand in the way of preventing infection with stomach worms, the problem of control is apparently a hard one. Fortunately there are various medicinal remedies which are more or less efficacious against stomach worms, and if satisfactory rotation methods can not be discovered it is likely that a practical solution of the stomach-worm question may be accomplished with the aid of some sort of medicinal treatment, just as the use of arsenical dips has proved to be the solution of the tick-eradication problem. Considerable work on a small scale has already been done in the Bureau of Animal Industry upon the question of controlling stomach worms, and recently more extensive investigations have been undertaken, with the inauguration of experiments to be carried on under approximately practical conditions upon a farm of 160 acres leased for the purpose near Washington."

The following again is a matter of interest :—

" With reference to the various species of parasites of live stock for whose prevalence the nuisance of unrestricted dogs is responsible, and whose control depends upon properly controlling dogs, it is of interest to note that another parasite has recently been added to the list by the discovery (Ransom, 1912; 1913) that the muscle cysticercus of sheep known as *Cysticercus ovis* is the intermediate stage of a previously unrecognised tapeworm of the dog (*Taenia ovis*). This parasite is very common in the United States and probably also in other countries. During the last fiscal year 39,639 sheep carcases out of a total of 12,909,089 slaughtered under Federal inspection were retained on account of infestation with this parasite—about 0·3 per cent. Owing to the difficulty of discovering the parasite many cases of infestation are undoubtedly overlooked, and the percentage of sheep infested is probably much greater than that given."

IMES (Marion). **Sheeb Scab.**—*U. S. Dept. Agric. Farmers' Bull. 713.* 1916. Apr. 17. 36 pp. With 21 figs. 1916. Washington: Government Printing Office.

—— **The Sheep Tick and its Eradication by Dipping.**—*Ibid. Bull. 798.* 1917. May. 31 pp. With 15 figs.

—— **Cattle Lice and How to Eradicate Them.**—*Ibid. Bull. 909.* 1918. Feb. 27 pp. With 14 figs.

These publications of the Zoological Division of the United States

Bureau of Animal Industry contain a very large amount of concise information regarding the skin parasites mentioned above, together with methods for their eradication. This information is, however, mainly intended for the use of laymen, and is of an elementary nature, but as the method of dipping for the control of ectoparasites has now been practised with success on such a large scale in the United States it is considered, judging from the experience that must have been gained, well worth reproducing some of the plans given for the construction of cattle and sheep-dipping plants.

The figures reproduced on following pages are those of the plants with concrete or cement vats recommended for cattle and sheep and of the plant with wooden vat for cattle; the following details with regard to the construction of the cattle dipping vats are reproduced.

"The dipping vat may be constructed either of cement or of lumber—the cement vat being preferable, as when properly made it is more durable and in many other ways more satisfactory than a wooden vat. The sides may be perpendicular, as shown in the plans for a cement vat (fig. 11), or sloping, as shown in those for a wooden vat (fig. 10). Sloping sides are generally considered more desirable than perpendicular ones for either cement or wooden vats. Both styles, however, are shown in the drawings, because some stockmen prefer vats with perpendicular sides. The dimensions shown in the cross section of the wooden vat may be followed in constructing a cement vat with sloping sides.

"The length of the vat may vary from 24 to 100 feet, depending on the number of cattle to be dipped. The top may extend 9 to 18 inches above the surface of the ground or may be flush with it. A vat of the former kind affords better conditions for handling the cattle than one of the latter kind. If it is desired that the top be flush with the ground, the vat should be built so that it extends 5 inches above the natural surface of the ground, which is then graded up with gravel or cinders and a dry path along each side of the vat thus provided.

"The slide board should be made of or covered with a smooth-surfaced material, such as planed lumber or sheet metal. A piece of boiler plate makes an excellent slide board. The dimensions of the slide board shown in connection with the cement vat are those commonly used. A short, steep slide board causes the animals to plunge abruptly into the dip, while a long gradual slope allows them to slide in more gently. The short, steep slope has the advantage that the animals cannot brace themelves on it for a leap as easily as on the long, gradual slide.

"The exit incline or crawling board in small vats should be about 16 feet long, so that the incline may not be too steep. In cement vats a false floor to which the cross cleats are nailed is usually laid on the exit incline. Bolts should be embedded in the concrete for fastening the false floor. The plans for the concrete vat show the lower end of the floor held in position by a cross pipe embedded in the concrete and the upper end and middle held by bolts.

"If permanent pipes are used for conducting water and dip to the vat they should be laid so as not to act as obstacles to the men working along the vat. There should be no obstruction in the path along both sides of the vat; neither should there be any cross pieces over the top of the vat that may interfere with the proper handling of the cattle while they are in the dip.

"The wooden vat shown in the plans has sloping sides, but, as already stated, they may be made perpendicular if desired. When soft wood is used for the frame timbers they should be 6 by 6 inches, but if hard wood is used 4 by 4 inch timbers are sufficiently large for the purpose. Cedar posts make good framing timbers, as they do not rot rapidly. Matched planks 2 inches thick should be used in building the vat, and they should be bevelled so that all joints and seams may be properly caulked with oakum and rosin or similar material.

"A water trap with hinged cover is shown in the exit incline of the wooden vat. While dipping is in progress both the cover and the valve to

IMES (Marion). *U.S. Dept. Agric. Farmers' Bulletin*, 798.] [*Trop. Vet. Bull.* Vol. 6. No. 2.

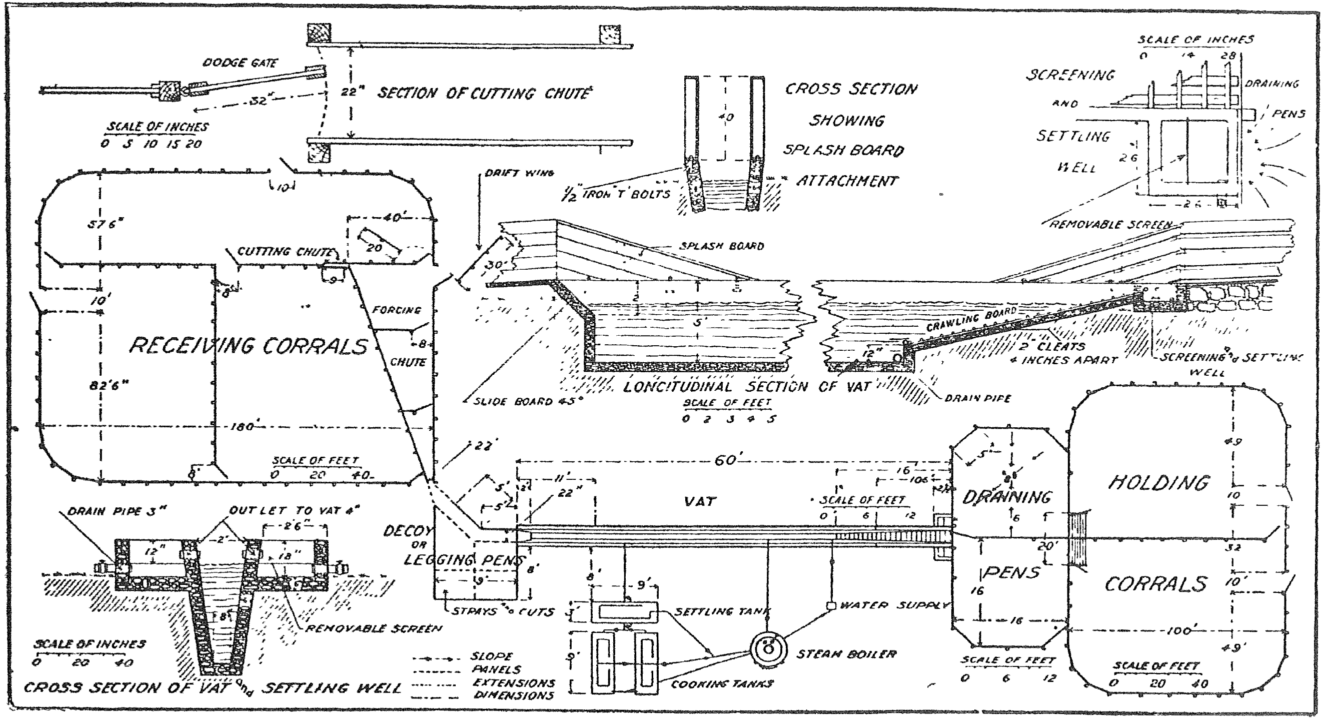


Fig. 15. Plan of sheep-dipping plant; cement vat.

[Reproduced by permission of the United States Dept. of Agriculture.]

IMES (Marion). *U.S. Dept. Agric. Farmers' Bulletin*, 909.] [*Trop. Vet. Bull.* Vol. 6. No. 2.

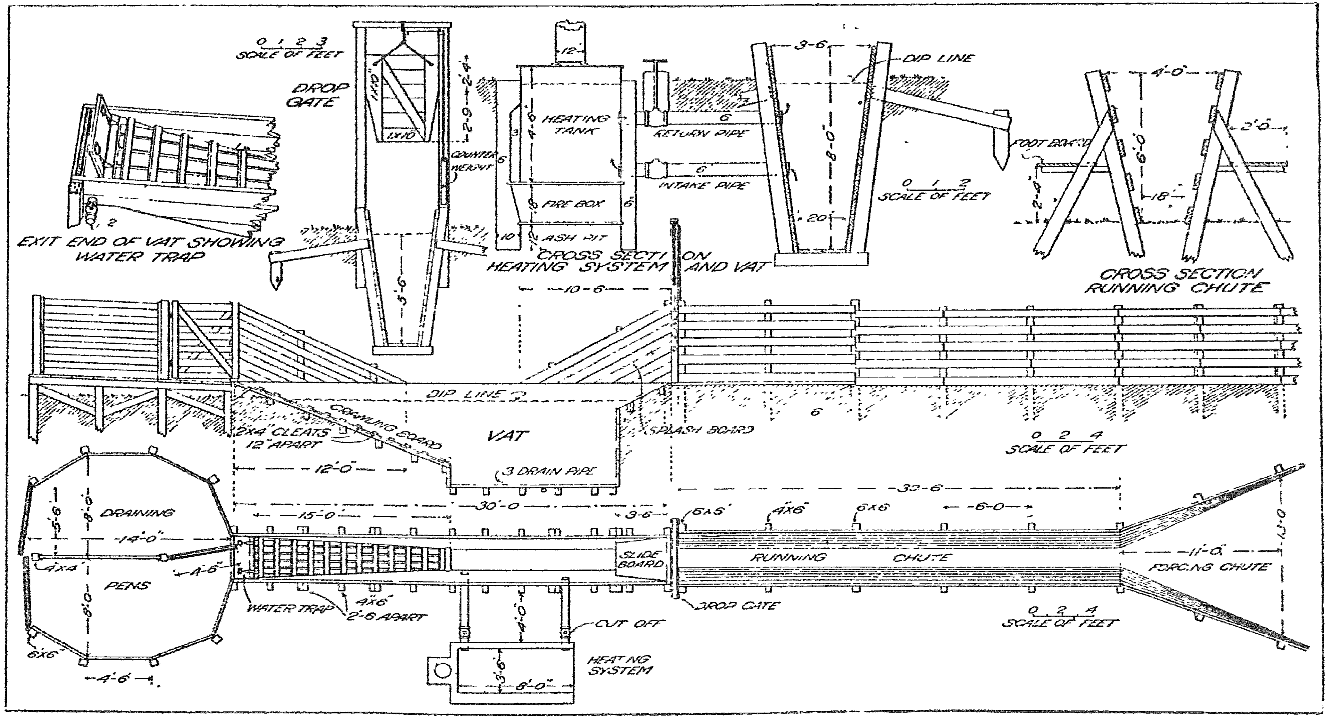


Fig. 10. Plan of cattle-dipping plant with wooden vat.

[Reproduced by permission of the United States Dept. of Agriculture.]

IMES (Marion). *U.S. Dept. Agric. Farmers' Bulletin*, 909.]

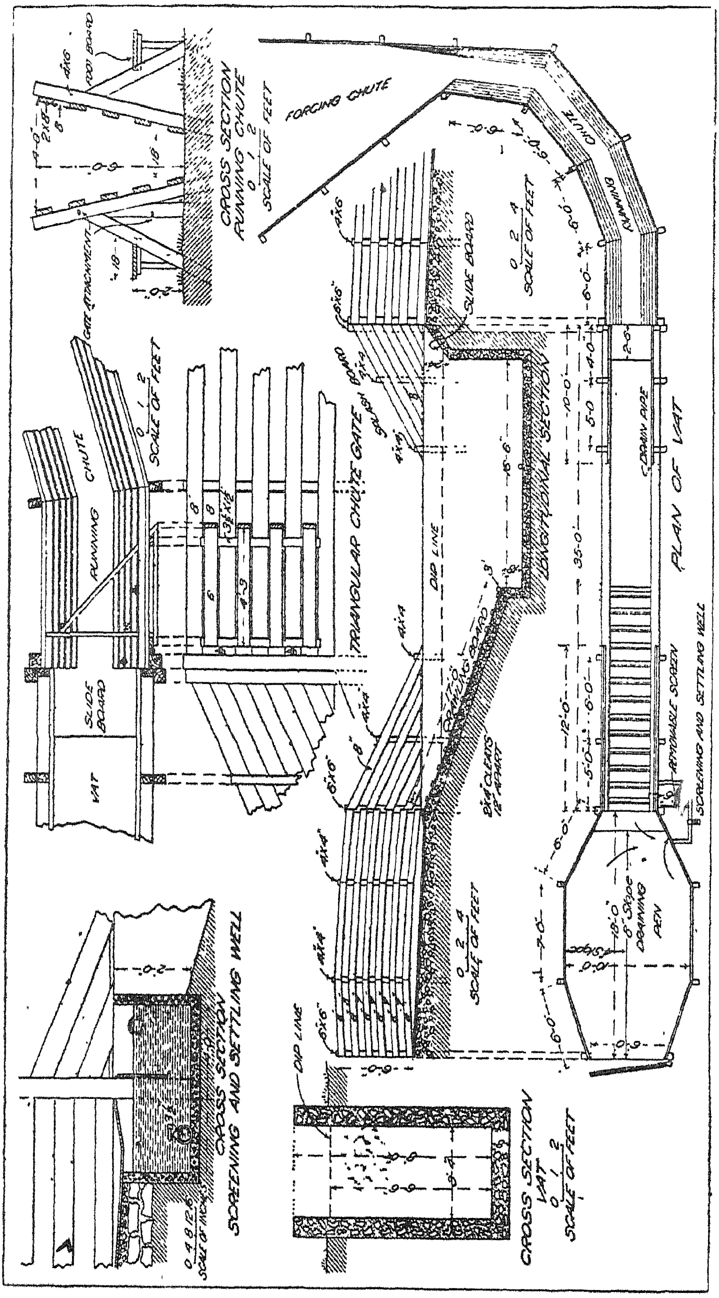
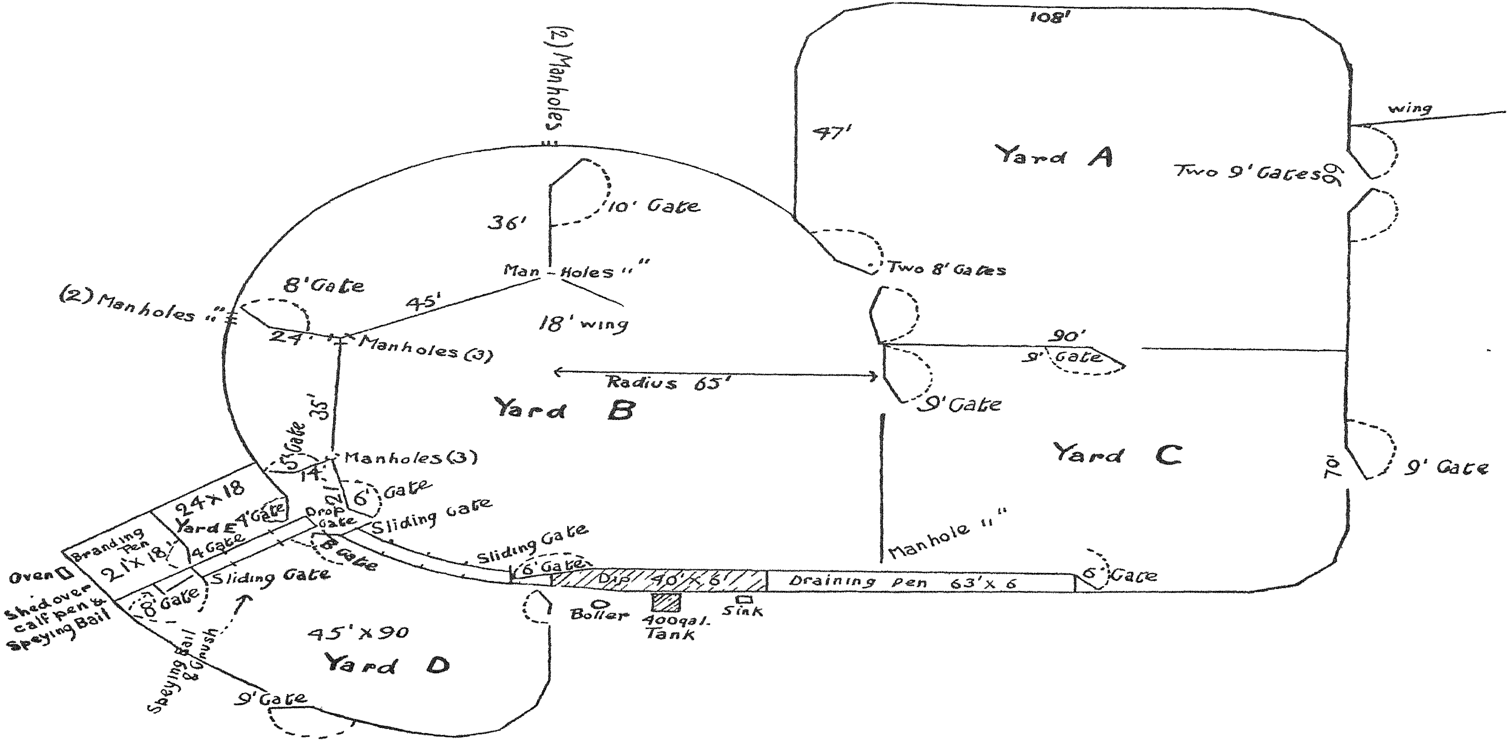


Fig. 11. Plan of cattle-dipping plant with concrete vat.

[Reproduced by permission of the United States Dept. of Agriculture.]



Ground Plan of Cattle Yards and Dip for Branding, Weaning, Speying, Inoculating, and Dipping; to hold 800 Head. When the Yards are only required for Dipping, Yards D and E are omitted. For dipping small numbers of Dairy Cattle, Yards A and C may also be omitted.

[Reproduced by permission from the *Queensland Agric. Jl.*

the drain pipe should be closed, but when dipping is finished for the day both should be opened so that water from the draining pens in case of rain may not run into the vat and dilute the dip.

"Heating equipment is necessary in the case of those dips which are used warm. That shown in the plans of the wooden vat may also be built in connection with a cement vat. When the open-tank heating system shown in the plans is used settling wells are not necessary, as the heating tank answers the purpose of a settling well. This system has an advantage over the old-style coil heater in that the pipes may be easily kept from clogging. Another method of heating, and the one usually employed, is to install a 25 horsepower boiler and to pipe the steam to the vat, where it discharges into the dip through perforations in a pipe laid along the bottom of the vat for about two-thirds its length. The water condensing from the steam passing into the vat from the boiler dilutes the dip to a slight extent, and for this dilution an allowance should be made in replenishing the dip.

"The trench for the vat should be excavated so that the inside dimensions correspond with the outside dimensions of the completed vat. If the sides of the trench are reasonably firm they may be used for the outer walls of the form, but in all cases where the vat is extended above the surface of the ground it is necessary to build forms extending from the ground surface to the top of the vat. If the soil is sandy or the walls cave in it will be necessary to use outer forms, in which case the trench should be wide enough to allow for these forms.

"The forms usually are made of 1 inch boards and 2 by 4 inch braces, but as a supply of 2 inch lumber is necessary for the corrals and chutes, some of this lumber may first be used for the forms and afterwards for constructing corrals and chutes. . . .

"Bolts for fastening the crawling and slide boards and the drain and other pipes should be placed in position in the forms before the concrete is laid. The concrete side and end walls may be reinforced with heavy woven wire, in which case the reinforcements should be placed properly in the forms so that they may be embedded in the middle of the walls.

"The concrete for dipping vats should be made of 1 part of Portland cement by measure, 2½ parts of sand, and 4 parts of screened gravel or crushed stone. The sand should be coarse, clean, and free from foreign matter. The crushed stone or gravel may vary in size from one-quarter to 1 inch in diameter. The mixing should be done on a smooth, tight, platform and the sand and rock measured separately in a bottomless box 2 feet long, 2 feet wide, and 1 foot deep, having a capacity of 4 cubic feet. For 2½ cubic feet mark the inside of the box 7½ inches up from the bottom. Each sack of Portland cement is considered equal to 1 cubic foot. Mix thoroughly the sand and cement, add the crushed stone (previously drenched with water), and mix the whole mass by turning it several times with shovels. Then add water in a depression made in the centre of the pile and mix well by turning several times with shovels, adding sufficient water during the mixture to make a quaky or thin jelly-like mixture.

"The placing of the concrete in the forms should be commenced as soon as the mixing is finished. The floor and exit end should be laid first and the concrete well tamped. In filling the forms the concrete should be settled into place by spading rather than tamping, and special attention should be given to spading next to the inside forms to force back the coarse particles and allow the sand-cement mortar to form a dense, water-tight surface. An old hoe straightened out makes a good spading tool, as the handle is long enough so that the bottom of the forms may be reached. If it is necessary to stop work for the day before the forms are filled, the surface of the concrete in the forms should be roughened with a stick. Just before placing additional concrete wash the roughened surface and paint it with cement and water mixed to the consistency of thick cream. Leave the forms in place two or three days, if possible, and wet the concrete daily. After the forms are removed, dampen the surface of the concrete and apply a finishing coat composed of 1 part of cement and 2 parts of sand, or mix cement and water to the consistency of cream and apply it, brushing well to form a smooth surface."

White (E. E. D.). Dipping Cattle.—*Queensland Agric. Jl.* 1917. Oct. Vol. 8. Pt. 4. pp. 207–209. With 1 plate.

This short article is held to convey "the opinions of an experienced stockman on an unfenced holding carrying 17,000 cattle and working eight dips" in North Eastern Queensland.

The losses among cattle due to ticks (*Margaropus annulatus australis*) when they first appeared in that region 20 years ago amounted to 60 per cent. At present the progeny of those cattle in this badly infested territory have acquired an immunity towards diseases transmissible by ticks, but the losses caused by tick irritation are not generally realised, and are said to amount to 80 per cent. of the total female cattle branded each year. Although present conditions preclude the idea of eradicating the ticks the author suggests that in view of the loss of condition now caused their suppression by means of systematic dipping must be regarded as the best possible investment for the cattle owner.

In the dipping of cattle attention should be paid to the following points. The dipping tank should be 6 feet wide in order to reduce the risk of cattle injuring each other and should be provided with a long incline and wide steps at the exit to assist the movement of weak cattle. The draining yard should be long and from 8 to 12 feet wide. The dipping tanks should be distributed so that cattle need not be driven more than 7 to 8 miles. The frequency of dipping must depend on the nature of the country. In certain parts it was found necessary to dip every three weeks throughout the year, while in other areas an occasional dipping suffices. In the tableland country it was found best to perform dipping operations from April to July for during that period the grass is good, the cattle strong, the weather cool, and the ticks, if unchecked, are increasing at a rapid rate; one dipping at this time is worth more than four in August (in Australia). It has often been stated that weak cattle and fattening bullocks should not be dipped but the author's experience indicated that in both cases dipping resulted in improved condition; it was found advisable not to put cattle on the road for at least five days after treatment. Calves were dipped from two weeks of age upwards, but the strength of the dip should be less than the accepted standard in their case to avoid any risk of loss.

Sinclair (J. M.). Management of Dipping Tanks.—*Rhodesia Agric. Jl.* 1918. Feb. Vol. 15. No. 1. pp. 32–33.

"In a paper entitled 'Notes relating to Arsenical Dipping Fluids,' by Mr. A. G. Holborow, F.I.C., Assistant Agricultural Chemist, which appeared in the December, 1915, issue of the *Journal*, it is stated that 'it should be an easy matter, knowing the volume of liquid in the tank and the exact strength of it, to rectify any deviation by adding water only, or dip, as the case may be, and bring the dipping fluid to any desired strength.' The writer agrees entirely with this view, but his experience shews that many owners and managers of tanks find a considerable difficulty in doing so. In some cases the reason is that the capacity of the tank inch by inch is not known, or, if known, is not made use of in calculating the quantity of water or dip required to bring the liquid in the tank to the proper strength. In other cases, the quantities are calculated in a haphazard or crude manner, with the result that the strength may be so increased as to cause damage to the cattle, or so diminished as to be ineffective. The tendency in the majority of cases is in the latter direction, probably because the persons concerned, not being quite sure of their quantities, prefer to err on the side of safety.

"The following notes on the management of the dipping solution and dipping tanks generally will, it is hoped, be of some assistance to stock owners.

"1. At the first filling the water should be measured into the tank by a 200 gallon or other convenient measure.

"2. From the 3 feet 6 inches level the volume, inch by inch, should be carefully recorded and marked on the wall of the tank, or preferably on a measuring rod, which can be obtained at a small cost.

"3. The level should be recorded after each dipping and again before the following one.

"4. Any decrease due to evaporation should be replaced by water only.

"5. Any increase due to rain or flood water should be made up to standard strength by the addition of the corresponding quantity of dip.

"6. When a sample is taken for analysis the quantity of solution in the tank at the time should be accurately estimated, otherwise it is impossible to rectify any excess or diminution of strength shewn by such analysis.

"7. The following example is given of correcting the strength of the solution in the tank on receipt of the result of the analysis :—

"(a) capacity of tank at proper dipping level—3,000 gals. ;

"(b) prescribed strength of dip used—say, 1 to 150 gals. of water ;

"(c) quantity of solution in tank at date sample was taken—say, 2,400 gals. ;

"(d) assume analysis shews strength—1 in 200 ;

"(e) then the 2,400 gallons in tank contain 12 gallons of dip only, instead of 16 gallons ; therefore, 4 gallons of dip must be added to bring the solution up to proper strength ;

"(f) there remain the 600 gallons of water required to bring the volume in tank up to the proper dipping level ; this requires another 4 gallons of dip ;

"(g) the total quantity of dip, therefore, which is required to rectify the diminished strength of the solution in the tank, and provide for the 600 gallons of additional water added to the tank, is 8 gallons.

"8. Where necessary, the tank should be protected by drains, to prevent the dip being flooded out on to the surrounding veld.

"9. When not in use, the entrance and exit of kraals and draining pens should be properly secured.

"10. The draining pens should be so constructed that dip cannot collect in them.

"11. The drums, whether closed or not, containing the concentrated dip should be kept under lock and key.

"12. When emptied, the drums should be immediately and thoroughly washed, and the washings placed in the tank or buried.

"13. Where kraals are used in addition to draining pens, in order to allow cattle to drip and dry completely, cattle should not be allowed into them until any water which may have collected in pools has been dispersed.

"In forwarding samples of dipping solutions for analysis, the greatest care should be taken to ensure that the bottles in which they are forwarded, and the utensils used for filling the bottles, are absolutely free from extraneous arsenic."

JARVIS (E. M.). **Report on Ixodic Lymphangitis (German East Africa Campaign, 1916-1917) made to the A.D.V.S., Dar-es-Salaam.**—*Vet. Jl.* 1918. Feb. Vol. 74. No. 2. pp. 44–53.

In this paper the author gives a somewhat loose description of a number of conditions resulting from secondary infection of the wounds caused by the bites of ticks of the species *Amblyomma variegatum.* The animals affected are horses, mules, asses, and more rarely cattle and sheep; the symptoms and lesions which may occur on the lower part of the limbs, on the body, or may be confined to the skin are of a very acute or of a chronic character according to the type of organisms introduced. These organisms include the Preiz Nocard bacillus, *Cryptococcus farciminosus* (occasionally), the necrosis bacillus, staphylococci, and other organisms. Numerous cases of the disease were observed by the author in Southern Rhodesia, but it seems to have disappeared from that country since measures were taken for the eradication of the tick. In East Africa a certain proportion of cases may be caused through the agency of Stomoxys.

SIGWART (Hans). **Beitrag zur Zeckenkenntnis von Deutsch-Südwestafrika, unter besonderer Berücksichtigung der Funde in den Bezirken Outjo und Waterberg.** [The Ticks of German South West Africa, with Special Reference to those found in the Districts of Outjo and Waterberg.]—*Ztschr. f. Infektionskr. . . . d. Haustiere.* 1914–1915. Vol. 16. No. 6. pp. 434–444. With 1 map & 6 text-figs.

The author's investigations were carried on from September 1912 to May 1914. It appears that the climatic conditions of what was formerly German South West Africa are not very favourable for the rapid multiplication of ticks. The rainy season is sharply differentiated from the dry season. The rains lasted in the districts visited from about the beginning of December to the end of April and the rainfall varied from 100 to 700 mm. After this period of excessive moisture the ticks have to face a dry period of from six to seven months with nocturnal temperatures often below 0° C. Thus during the months in which the ticks were most numerous (February to April) they were by no means obvious on any of the domesticated animals and could only be found in considerable numbers within the ears, in the inguinal region, or around the genital organs. From May till September the domesticated animals and wild game are often found to be quite free of ticks. The author gives a list of the ticks found together with their morphological characters and prevalence. The species found were as follows:—

(a) Argasidae: *Argas persicus,* found in abundance in most fowl houses.

(b) Ixodidae: *Aponomma exornatum,* found in one locality.

Hyalomma aegyptium, or spotted-legged tick; this is by far the most common tick and was found in every district visited; it was found, but only in the adult stage, on equines including zebras, cattle, sheep, goats, oryx antelopes, small antelopes, wild pigs, and also on the dog and man. This tick is of great importance on account of its capacity of acting as a transmitting agent of redwater in cattle.

Rhipicephalus evertsi var. *mimetica* Dönitz, a tick showing an extraordinary resemblance to *Hyalomma aegyptium* in shape and colour, but somewhat smaller in size. It would be a matter of interest to determine whether this variety of *R. evertsi* is capable of acting as vector of East Coast Fever. This fairly common tick was found on horses, cattle, sheep, and goats ; nymphs were also taken from cattle.

R. oculatus, a widespread tick found especially in considerable numbers on hares ; other hosts in order of decreasing importance were the small antelopes, the sheep, the goat, the dog, equines including zebra, and cattle. The predilection seat of the tick was within or in the neighbourhood of the ears and on those parts of the body covered with thin skin. The larger animals were seldom infected. Nymphs were found on a dog and an ox.

R. sanguineus was found in two localities and the hosts included equines, wild pigs, the sheep and dog. The dog appeared to be the favourite host.

Rhipicentor bicornis and *Haemaphysalis leachi* were found to infest canine animals only and the latter tick especially was of very rare occurrence.

YAKIMOW (W. L.), SCHOCHOS (N. I.), KOSELKIN (P. M.), WINOGRADOW (W. W.) & DEMIDOW (A. P.). **Die Mikrofilariose der Pferde im Turkestangebiete.** [Equine Microfilariasis in Turkestan.]—*Ztschr. f. Infektionskr. . . . d. Haustiere.* 1915. Vol. 16. No. 4. pp. 275–286. With 1 text-fig.

Yakimow and his assistants discovered that among certain military units in Turkestan the horses were found to harbour microfilariae in their blood in proportions varying from 0·53 to 37·6 per cent. Civilian horses were also examined and the proportion of infected animals varied from nil in the case of animals slaughtered at Taschkent slaughterhouse to 8·1 per cent. in a certain township. The horses belonging to the military units affected most considerably were in poor condition and a characteristic symptom among infected animals was the presence of abrasions on the skin due to irritation, especially around the nostrils. Sometimes oedematous swellings were observed on the chest, belly and limbs. In some cases the horses showed rapid exhaustion and dyspnoea on being put to work.

The haemoglobin content of the blood fell in some cases down to 60 per cent. and there was marked eosinophilia (up to 11·7 per cent). There was sometimes an increase in the percentage of lymphocytes (up to 48·8 per cent.) whilst the polynuclear neutrophiles showed a corresponding decrease (down to 40 per cent). Myelocytes and transition forms were also sometimes seen.

The microfilaria possessed an elongated cylindrical body gradually tapering towards its posterior extremity; the anterior end was rounded. The whole body was surrounded with a thin transparent cuticular sheath projecting some distance beyond the extremities of the nucleated column. The nucleated column usually showed three clear spots situated at distances of 5·68—10·65μ, 38·34—52·25μ, and 142—172, respectively, from the anterior end. The nucleated body stained of a blue or violet-blue colour with Giemsa while the sheath stained pink or remained colourless. The length of the parasites was as follows;—without sheath 158·98—266·96μ, with sheath 270·45—323·76μ; the breadth was, without sheath 4·26—9·94μ, with sheath 7·10—11·36μ.

No diurnal periodicity was observed. The authors failed to infect a horse, an ass, and two sheep by subcutaneous injection of blood containing numerous microfilariae. Intravenous injection of salvarsan produced no diminution in the number of parasites in the blood.

The authors state that the microfilaria observed by them bore considerable resemblance to the parasite discovered by MANDEL (1910) in the blood of horses in Germany and also to the embryos of *Filaria equina* Abildgaard, 1789 (=*F. papillosa* Rudophi, 1802), the filaria commonly found in the peritoneal cavity of equines. MANDEL, however, described the occurrence of albuminuria in his cases, whereas this symptom was absent in the horses examined by Yakimow. Inasmuch as the blood parasite appeared to differ from the microfilariae already described in the literature the authors propose the name *Microfilaria ninae kohl-yakimovi* for it. [For further details in connection with microfilariae of horses see WIRTH (this *Bulletin*, Vol. 5. No. 4. p. 237).]

STEWART (F. H.). i. **On the Life-History of *Ascaris lumbricoides*.** Preliminary Note.—*Brit. Med. Jl.* 1916. July 1. No. 2896. pp. 5–7. With 4 text-figs.

ii. **Further Experiments on Ascaris Infection.**—*Ibid.* 1916. Oct. 7. No. 2910. pp. 486–488.

iii. **On the Life-History of *Ascaris lumbricoides*.**—*Ibid.* 1916. Dec. 2. No. 2918. pp. 753–754.

iv. **On the Development of *Ascaris lumbricoides* Lin. and *Ascaris suilla* Duj. in the Rat and Mouse.**—*Parasitology.* 1917. Feb. Vol. 9. No. 2. pp. 213–227. With 1 plate comprising 12 figs. & 9 text-figs.

v. **On the Development of *Ascaris lumbricoides* and *A. mystax* in the Mouse. Part II.**—*Ibid.* 1918. Jan. Vol. 10. No. 2. pp. 189–196. With 1 plate.

vi. **On the Life-History of *Ascaris lumbricoides* L.**—*Ibid.* pp. 197–205.

Although the importance and ubiquity of Ascaris infection in man and the lower animals are universally recognised very little appears to have been added to our knowledge regarding the life-history of these round worms since the work of the earliest observers. The above articles written by Stewart thus comprise contributions of great general interest.

The following account of the small amount of literature on the subject is taken from the author's preliminary note.

> "The development of *Ascaris lumbricoides* is at present almost universally considered to be direct. It is well known that the eggs passed in the faeces of man undergo development in the outer world up to the formation of a motile vermiform embryo. The egg containing this embryo may readily reach the alimentary canal of man, and it is supposed that it there hatches, and that the larva, having escaped, develops in this site into the adult. This theory is based on the work of Davaine (1859–1863), Grassi (1887–1888), Calandruccio (1886), Lutz (1887–1888), Epstein (1892). Jammes & Martin (1896–1908), Martin (1913), and Wharton (1915). . . .

"Davaine administered ripe eggs to rats, and found that after 12 hours free live larvae were to be found in the lower part of the small intestine. He also introduced ripe and unripe eggs in glass capsules closed with linen into the alimentary canal of a dog and found that after the lapse of a certain period the ripe eggs had disappeared, whereas the unripe eggs remained. He concluded that hatching and development occurred in the alimentary canal of the definitive host.

"Grassi administered ripe eggs to himself, and two months later found eggs in his stools. Calandruccio infected a child of 10 which had previously suffered from worms, but had been relieved of these parasites by anthelmintics. Lutz fed an adult on ripe eggs, and found evidence of the subsequent appearance of adult worms. Epstein's work is unfortunately not available even in summary, but from the context of the references it is clear that he successfully infected man.

"Jammes and Martin worked on the line of experimental hatching of ripe eggs in artificial and natural solutions, and found that hatching took place readily and *en masse* in 0·8 per cent. salt solution (which they consider to be an alkaline solution) at 37° to 40° C. Martin found that the embryos of the ascarids from the calf, pig, horse and dog hatched best in alkaline solutions, and that when developed eggs were introduced into the alimentary canal of an animal they passed through the stomach unaffected, and only hatched after they had been subjected to the action of the alkaline juices of the intestine. . . .

"Wharton states that direct infection can take place, but that the embryos must be 'completely developed.' He does not give the period necessary to secure this complete development.

"In spite of the general acceptance of the theory there is a considerable bulk of evidence against it.

"Davaine administered three to four hundred ripe eggs to an ox—an animal which is stated to harbour *Ascaris lumbricoides*—and found that after four months no worms were present in the intestine. Küchenmeister experimented with a dog, which, however, escaped from his observation. Leukart (1867) fed a rabbit on ripe eggs, and found no worms after ten days; a dog was also treated, and was equally unresponsive after 14 days. This very experienced helminthologist also fed a pig for three weeks on several thousand ripe eggs, and did not find any worms on section. An experiment on man was arranged in 1857, but it is not clear that it was carried out. He also administered to a horse the eggs of *Ascaris megalocephala*; to a dog those of *Ascaris marginata*; to a cat those of *Ascaris mystax*, with invariably negative results.

"Leukart, therefore, maintained that the life history of *Ascaris lumbricoides* would be found to be completed by an alternation of hosts. He supported this opinion by the facts known with regard to (1) *Ascaris acus*, which is found as an encysted larva in *Leuciscus alburnus*, and in the adult form in the pike, and (2) a larval *Ascaris* found encysted in the muscles of the mole, which, when administered to the buzzard continues to develop, although it does not yet become adult. He considered that Davaine's rat experiment, if correctly described, did not point to the direct development of the worm, but to the fact that the rat was an intermediate host. He pointed out the ease with which the larvae liberated in the faeces of the rat could be conveyed to the intestine of the definitive host—man. He attempted to confirm the experiment, but employed a mouse in place of a rat, and found that the eggs were passed unaltered in the faeces of the mouse. He therefore abandoned this line of research. He attempted to find the intermediate host among invertebrate animals, experimenting with a number of insects, snails, and earth worms, but without success. Von Linstow (1886) suggested that *Julus guttulatus* might be the intermediate host."

Stewart's experiments which were commenced in the spring of 1915 were carried out in Hong Kong, in which Colony and in Southern China generally ascariasis both in man and the pig is of extraordinary frequency. He later adds that "there is reason to suppose that a great deal of the debility of the natives of the tropics is due to ascariasis, and that this disease is at least equal to ankylostomiasis in economic importance."

Some preliminary experiments performed on the pig by feeding it with large quantities of ripe Ascaris eggs gave wholly negative results, thus confirming LEUKART'S experiment with the same animal, and furnishing strong evidence that the whole development did not take place in the definitive host. In order to ascertain whether the worm underwent a portion of its life cycle in an intermediate host DAVAINE'S experiment with the rat was taken up, and as a result of a number of carefully performed researches some very interesting observations on the migration of the worm in this animal and in the mouse were made. These results are summarised as follows:—

"When eggs of *Ascaris lumbricoides* Lin. or *A. suilla* Duj. containing mature embryos gain entrance to the alimentary canal of the sewer rat, *Mus decumanus*, or the mouse, *M. musculus*, they hatch. It is not possible to say at present in what part of the alimentary canal hatching takes place. (The number of animals suitable for experiment at the disposal of the writer is unfortunately so small that he is unable to devote any of them to the working out of the details of the process.) A certain proportion of the larvae thus liberated escape in the faeces where under suitable circumstances they can live for at least three days. It is, however, probable that they ultimately succumb and that this is not the true mode of development.

"The majority of the larvae gain entrance into the body of the host. The exact point of entrance and the time after hatching at which entrance takes place have not been determined. Some animals show signs of illness on the second day after infection. The time elapsing between infection and the entrance of the larvae into the body is therefore probably not more than two days.

"Larvae are found in the lungs and liver of the host not later than four days after infection and possibly as early as two days. Sections of the tissues show that they are situated in the air vesicles of the lung and in the blood capillaries of the liver close to the interlobular branches of the portal vein.

"Larvae are not found in the liver after the fifth day from infection. They are found in the bronchi about the seventh day and in the trachea on the eighth day.

"No larvae are found in any portion of the lung on the ninth day after infection. Dead larvae have been found in the stomach and rectum on the ninth day after the last infection.

"The route by which the larvae reach these sites is of course not definitely proved but from anatomical considerations it is hardly possible that it can be other than one of the two following (the diameter of the larva is three times that of a red blood corpuscle of the mouse. The larva could therefore not pass through the lumen of an ordinary capillary vessel):

"(1) Boring through the wall of the stomach or intestine the larva enters a mesenteric venule and is carried to the liver. It is here arrested at the entrance to the hepatic capillary plexus and it is for this reason that so many larvae are found in the capillaries close to the interlobular veins. The liver undergoes extreme and acute fatty degeneration so that the larvae are able to penetrate along the capillaries between the degenerated columns of liver cells into the hepatic venules. Thence they pass in the hepatic vein to the heart and by the pulmonary artery to the lung. They are of course at once arrested by the pulmonary capillary field. Embolism of the smaller branches of the pulmonary artery takes place with haemorrhage around these arterioles. The larvae readily work their way along with the effused blood into the air vesicles and thence into the bronchi and trachea.

"(2) The larva after hatching in the stomach or duodenum travels up the bile duct and reaches the bile capillaries of the interlobular zone.

It here bores its way through the degenerated liver tissues and reaching the hepatic venule continues its course as in the first case.

"During the residence in the body of the rat or mouse the larvae grow from a length of 0·22 mm. to 1·4 mm. The proportion length of oesophagus / total length diminishes from 1 /2·5 to 1 /6·1. The ventral line which is the greatest of the longitudinal lines in the embryo is reduced to the same dimensions as the dorsal and lateral lines. The ventral gland (the rudiment of the excretory system) is developed from a cell of the ventral line, enlarges very greatly, acquires the massive nucleus characteristic of *Ascaris* larvae (Stewart, 1906; Baylis, 1916) and finally develops its duct from the cells of the ventral line. The intestine, anal canal and anus become pervious. The rudiment of the female gonads appears."

It appeared from the results of the first experiments that the larvae which had reached the trachea and mouth on the eighth day after infection migrated in the saliva of the rodent on to food substances such as bread. It was shown that they could live for 24 hours on damp bread. Experiments also tended to prove that the larvae from the lungs of rodents could infect the pig and that in nature infection of the pig and man probably took place by means of food contaminated with the saliva of rats or mice. However, the author performed a series of further feeding experiments with *Ascaris suilla* eggs and thereby traced the life-history in the rodents from the eighth to the 15th day after infection and thus found that the preceeding statements required some modification.

"Larvae are found in the mouths of infected mice on the 8th day, on which day they are also, as previously stated, abundant in the lungs and trachea. They persist in the lungs up to the 15th day. On the 9th day they begin to travel down the alimentary canal and may be found in small numbers in the stomach, small intestine and caecum. On the 10th day this stage is fully established, the larvae travel with some rapidity through the stomach and small intestine and accumulate in the caecum and upper colon where as many as 60–70 may occur. On this day they also commence to pass out in the faeces. The passage from the lungs to the caecum continues up to the 15th day and larvae occur in the faeces on the 16th day.

"Between the 9th and the 15th days the larvae increase in length. They measure from 1·3–2 mm. on the 10th day and 1·75–2·37 mm. on the 15th."

The author then gives details with regard to the anatomy of the larval human and porcine ascarids from the large intestine and faeces of the mouse between the 10th and 15th day after infection.

In a further series of pig-feeding experiments it was shown that ripe eggs of *Ascaris suilla* could hatch in the intestine of the pig; the larvae issuing from these eggs entered the body of the pig and pursued the same course through the body as in the rat and mouse. They were found in the lung of the pig from the sixth to the eighth day; dead larvae were found in the faeces of the pig on the 11th day after infection. The migration of the larvae caused severe dyspnoea and cyanosis in two of the pigs four days after feeding, and death on the eighth day; enormous numbers of larvae were found in the lungs and trachea. In the third pig killed six days after infection the pleura was found studded with small patches of ecchymoses; ascarid larvae were present in these patches and throughout the lungs in large numbers; none were found in the liver.

The production of pneumonic symptoms by feeding with eggs of ascarids was observed as long ago as 1860 in a remarkable experiment performed by MOSLER on the human subject.

> "Mosler, after a preliminary and negative experiment on himself, administered ripe eggs of *A. lumbricoides* to a number of children, at first in small numbers, but later several dozen to each child. No worms were at any time evacuated after anthelmintic treatment but in one (or two) of the children, fever with dyspnoea occurred a few days after the administration of the eggs. Leuckart adds that it is of course doubtful whether this fever was due to the experiment. There can now however be little doubt that the fever and dyspnoea were due to pulmonary ascariasis, the dose in one or two cases having probably exceeded several dozen."

The question still remains open as to whether the ascarids of man and the pig undergo their complete normal development in man and the pig. Thus, (a) the development in the rat and mouse is merely an accidental development in an abnormal host, or (b) the rat and mouse are intermediate hosts and the larvae passed in the faeces of these rodents can either at once or after further development infect the definitive host. The former hypothesis appears simpler and should be easily susceptible of proof or disproof by a moderately numerous series of experiments. The infectivity of the material administered could be established by the subsequent appearance of pneumonic symptoms between the seventh and the tenth days after feeding or by testing the material on rodents in which animals a pulmonary infection appears to follow constantly after artificial feeding with live eggs. Six experiments of this kind were performed. In two of these the pigs undoubtedly suffered subsequently from Ascaris pneumonia; in another there was also some evidence of this condition; the culture used on two of the remaining three pigs was proved active on mice, while in the remaining case four different cultures were employed, the eggs in each case containing active embryos. The results obtained by post-mortem examination of the pigs some time afterwards showed that out of six experiments five were negative and only one possibly positive.

> "Considering the very large number of larvae which must have reached the intestine, more than a thousand in each case, and the regularity and certainty with which the hepatic-pulmonary infection follows the administration of eggs in both the rat, mouse and pig, the evidence of these six experiments is opposed to the hypothesis of direct development without an intermediate host. Nevertheless, six experiments are not sufficient to decide the matter and it must therefore still be considered unsolved."

Two controlled experiments were performed in order to determine whether pigs could be infected with the larvae from mice. It was difficult to obtain a sufficient number of larvae from the caecum of the mouse for if large doses are given to this animal it dies before the ninth day, while if small doses are given only very small numbers of larvae are subsequently found in the caecum. Positive results were apparently obtained in one experiment, but the author rightly draws no conclusions from the small number of experiments performed.

Experiments were then made in order to determine a method of obtaining numbers of Ascaris larvae from the caeca of mice.

With regard to the anatomy of the larvae of *Ascaris suilla* from the pig the only difference noted, compared with the larvae from rodents, was that the excretory gland lay slightly further back, the nucleus being on a level with the posterior end of the oesophagus.

Dealing with the economic importance of ascariasis in pigs Stewart quotes the American author, Lynch, who states that "in the large packing houses of Chicago, Kansas City and Omaha the parasites are found in large numbers in nearly half of the animals slaughtered." The Colonial Veterinary Surgeon, Hong Kong (GIBSON A.) estimates that at least 50 per cent. of the animals slaughtered at the abattoir of that colony are infected. The author himself examined 83 pigs from the Hong Kong Dairy Farm and found 24 per cent. infected. The animals on this farm were kept in exceptionally good sanitary surroundings and it might be expected that the infection would be low. With regard to the condition of these animals 44 were classed as doing well and 39 as doing badly. In the former group 11·3 per cent. were infected, in the latter group 33·3 per cent. The author, moreover, obtained information that pneumonia was a common disease of young pigs in the Colony and that a pig which had suffered from pneumonia was considered unthrifty and slaughtered forthwith to save waste of food. It is suggested that a certain number of these cases might be due to ascariasis.

Details are added regarding the development of the eggs of *Ascaris lumbricoides* in various media.

The early life history of, Ascaris mystax *Zeder* (A. marginata *Rud.*).—

"The development of the eggs of the *Ascaris* of the cat and dog has been studied by Nelson, Verloren, Davaine, Baillet and Grassi (Railliet, *Traité de Zoologie Méd. et Agric.*) and by Leuckart (*Menschl. Parasiten*, II. pt. 2, p. 275). . . .

"Segmentation and the formation of an active embryo have been found to take place in water and damp earth. Davaine (quoted by Leuckart) states that development takes place also in a dry condition. Leuckart gives the period necessary for the formation of an active embryo in summer as four to ten weeks and in winter several months. The fully formed embryo differs from that of *A. lumbricoides* in being larger, 0·36–0·42 mm. in length as compared with 0·3–0·38 mm. in the latter, and in bearing a more distinct boring tooth on the ventral aspect of the mouth. There are no signs of the oesophageal bulb of the adult with the exception of a slight swelling of the posterior end of the oesophagus. He gives a figure of the embryo.

"This investigator did not succeed by any means in bringing about the hatching of the eggs, nor did he produce any further development by feeding experiments. At one time he considered that he had empirically caused direct infection since he found young worms 3–4 mm. in length in the intestines of dogs which had been kept a long time in a kennel on the floor of which he found embryo-containing eggs. Repeated attempts at artificial infection in more than two dozen cats and dogs gave however negative results. He then attempted to find an intermediate host. He administered eggs of the worms to rabbits and mice and examined these animals after several weeks hoping to find encapsuled nematodes. No such nematodes were found. He states that the eggs passed unaltered through the alimentary canal of the mice.

"In a later experiment he placed a number of young cats in a particular dwelling in which a number of animals had recently been kept. The latter had been found to harbour numerous young Ascarids. The cats were fed on bread only. After six to eight days the cats were killed. They proved to be infected with Ascarids 4–8 mm. long. In the stomach of one of them, a kitten eight weeks old, 40 to 60 nematode larvae were found which measured 0·4–0·6 mm. The stomach also contained fragments of straw and potato. No explanation could be given of the mode of entry of these larvae. No animal remains were found in the stomach or intestine to point to an intermediate host.

"Grassi (I quote from Railliet's text-book) reared young puppies in a kennel soiled with egg-containing excrement. Their faeces contained *Ascaris* eggs on the 28th day and numerous Ascarids were found on section. A control experiment in sanitary surroundings proved negative. Grassi concluded that infection was direct."

In order to study the segmentation of the egg and development of the embryo the author made cultures of the eggs of *A. mystax* in a damp atmosphere at a temperature between 25° and 30° C. "Under these conditions development proceeded as follows:—1st day, unsegmented to three cell stage; 2nd day, advanced segmentation; 4th and 5th days, curved vermicules; . . . . 7th day, plump vermiform embryos; 8th day, active embryos."

Intermediate host of *A. mystax*.—Ripe eggs were administered to mice in their food. "Active Ascaris larvae were found in the liver between the 1st and 3rd days after infection." The material at the author's disposal was unfortunately not large enough to work out further details.

The specimens from the liver killed by heat in salt solution gave the following measurements. Larva 20 hours after infection, total length, 0·38 mm.; oesophagus length, 0·122 mm.; relation of length of oesophagus to total length, 1 to 3·11; maximum breadth, 0·017 mm. The length and breadth were practically the same as in the embryo, the oesophagus had shortened markedly. Larva on the third day after infection, total length 0·42 mm.; oesophagus, length, 0·130 mm.; length of oesophagus to total length, 1 to 3·23.

HALL (Maurice C.) & FOSTER (Winthrop D.). **Efficacy of Some Anthelmintics.**—*Jl. Agric. Res.* 1918. Feb. 18. Vol. 12. No. 7. pp. 397–447. With 5 tables & 1 text-fig.

Information with regard to the value of anthelmintic treatments in human and veterinary medicine has hitherto been based largely on clinical observations. A more satisfactory method of investigating the efficacy of the drugs employed would be to administer them to infected animals, collect all faeces passed for a number of days, recover from them all worms present, and then kill the animals and collect all the worms remaining in the digestive tract. With the data thus obtained it would be possible to express the efficacy of a drug in the form of a mathematical ratio. The experiments described by the authors in this paper were based on this principle. In some cases it is very evident that the number performed are somewhat inadequate for the purpose of formulating such ratios and, as the authors admit, these cannot be considered an accurate index of the efficacy of the drug except when based on extensive data, "since many factors, not entirely within control, such as the individual reaction of the animal, the amount of material in the alimentary tract, and the potency of the drug, all enter into the problem." However, their work is of value inasmuch as no such method as the above appears to have been employed by previous investigators, with the exception of HUTCHEON (1891), who made numerous tests of anthelmintic treatments for stomach worms in sheep and goats in South Africa, and STILES (1901–1902) who performed similar work in the United States of America. The following was the method adopted by Hall and Foster:—

> "The animals were given an appropriate dose of the anthelmintic to be tested, the method of dosage varying with the purpose of the experiment and the substance to be tested, preliminary purgation being undertaken or omitted as desired. Treatment was usually administered in the morning and all feces were collected every morning thereafter until the animal was killed. The feces were washed through a set of graded

screens and the screens examined for worms. The animal was usually killed the morning of the fourth day after the administration of the last dose of the anthelmintic, and all parasites remaining were collected and counted. The percentage of efficacy was then estimated from the number of worms found on post-mortem examination and that number plus the number passed after treatment. When preliminary purgation was resorted to, the feces were collected on the following day, the day of administering the anthelmintic, to ascertain what worms if any were removed by simple purgation."

The experimental data concerning these investigations, which were performed on dogs, sheep, pigs, cats, and poultry, are arranged in three groups representing, (1) simple purgatives including calomel, castor oil, and Epsom salts, (2) a group including anthelmintics of a mineral nature and coal tar products, including tartar emetic, chloroform, ether, iodoform, copper sulphate, gasolene, petroleum benzine, and the phenols, and (3) a group covering the vegetable anthelmintics including Oleoresin aspidii (or extract of male fern), pelletierine tannate, areca nut, santonin, thymol, turpentine, *Ficus laurifolia*, spigelia, tobacco, and oil of chenopodium.

According to this plan the writers endeavoured to test as many drugs as possible having a known or alleged anthelmintic value, abandoning those that give no results and making further experiments with the more promising. [It is very noticeable that a mineral compound of such recognised anthelmintic value as arsenic is omitted from their list.—Ed.]

The following conclusions are drawn up:—

"Making due allowance for the paucity of data in regard to certain drugs, the writers consider that the following may be reasonably advanced as the result of their investigations.

"Simple purgatives, calomel and castor oil, may have some slight value as anthelmintics, but it is hardly sufficient to justify their use for this purpose. Ascarids in dogs are sometimes removed by castor oil given as a preliminary purge, and this fact may prove of benefit in veterinary practice as a diagnostic measure when the more accurate method of microscopic faecal examination can not be carried out. However, castor oil failed to remove ascarids more frequently than it succeeded, and in no case were all the ascarids removed from any one animal. As many of the experiments on dogs were preceded by a dose of castor oil, the writers have fairly extensive data on this subject.

"The most reliable vermifuge for ascarids, whether in dogs or swine, is oil of chenopodium. This drug, which was tested out on 34 dogs in six experiments, showed an efficacy for the entire series of 97 per cent. It rarely fails to remove all the ascarids present in a dog if given at the rate of 0·2 mil [1 mil = nearly 1 gramme] per kilo, preceded by a dose of castor oil and the animal starved for 24 hours before treatment.

"The chenopodium treatment is also very efficacious for ascarids in swine, and when properly administered may be expected to remove most, if not all, of the worms present. It would seem, however, that neither chenopodium nor any other drug tested will give satisfactory results if mixed with the daily ration and the animals allowed to dose themselves; it is best given to each pig individually in suitable dosage, preceded by a fast. While this method necessarily involves considerable labor when treating animals as unruly as swine, the labor can be reduced by sorting the hogs roughly into classes according to size and confining them in inclosures which will permit them to be caught with a minimum amount of struggling. The treatment has proved practical on a large scale and the results, as far as they could be determined, were entirely satisfactory.

"Oil of chenopodium appeared to be effective for stomach worms in sheep, although the data on this subject are not sufficient to warrant its recommendation. It is also of some efficacy for hookworms in sheep and in dogs, though in the latter case chloroform was found more reliable.

" Other remedies which seem to have more or less merit as anthelmintics against ascarids are the latex of *Ficus laurifolia*, santonin in repeated doses, and thymol. Although thymol in repeated doses is fairly efficacious against hookworms, it was inferior to chloroform for this purpose, causing more distress. An excellent preparation for mixed infestation in dogs consists of equal parts of oil of chenopodium and chloroform, given at the rate of 0·2 mil per kilo, combined with 30 mils of castor oil. This preparation may be expected to remove all the ascarids present, a large proportion of hookworms, and possibly a certain percentage of whipworms. This latter parasite seems to be very difficult to eliminate, and nothing tried by the writers proved very efficacious, almost any anthelmintic occasionally proving successful. This experience may perhaps be explained

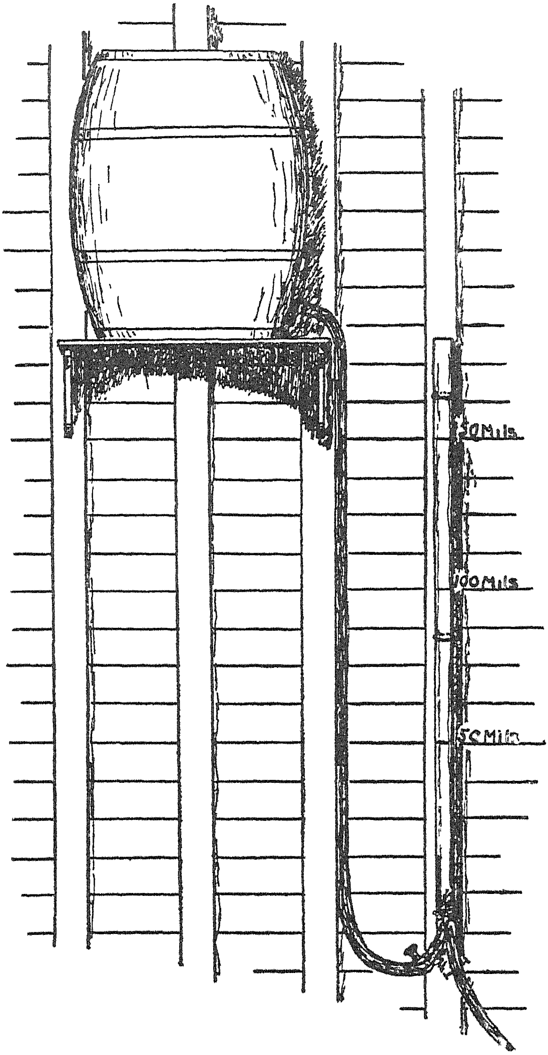


Fig. 1. Apparatus, with control, for administering copper-sulphate to sheep. [Reproduced by permission from the *Jl. Agric. Res.*]

by an intermittent peristalsis of the cecum, which occasionally allows the anthelmintic to enter, but which usually excludes it. Although chloroform was fairly successful in removing stomach worms from sheep, both animals upon which it was tried subsequently died from its effects, and it would seem to be too dangerous for use on sheep.

"In the case of stomach worms in sheep, copper sulphate was found to be the most satisfactory remedy, the experiments confirming the findings of Hutcheon. A simple apparatus (see fig.) devised by the senior writer reduces the labour involved in drenching a flock of sheep and insures accurate dosage. Petroleum benzin also proved satisfactory and was more efficacious for hookworms than copper sulphate. However, it is much more expensive than copper-sulphate solution, must be given three times, and in a vehicle like milk, which adds greatly to the expense. The fact that petroleum benzin (refined gasoline) proved efficacious, while commercial gasoline was considerably less so, is perhaps related to the differences in specific gravity and consequent volatility of the refined product compared with the commercial product.

"Among anthelmintics intended for use against tapeworms, male-fern proved efficacious when tested on dogs. In the case of cats it removed all tapeworms from 75 per cent. of the animals tested, though it proved fatal to two out of six animals which were somewhat enfeebled from disease. Apparently it is more toxic to cats than dogs and should be prescribed with caution and only given to healthy subjects. So far as can be judged from a single experiment with dogs, there seems to be no danger in combining male-fern with castor oil, as is done in the so-called Hermann's mixture. In fact, the writers are inclined to agree with Seifert (1908) that the administration of castor oil after male-fern will avoid the toxic effects of the latter by causing its rapid and thorough elimination, and that for this purpose no other purgative is quite so effective. This subject, however, should receive more study before conclusions are drawn.

"Pelletierine tannate was a failure in the one experiment in which it was tested on cats, but was efficacious on dogs. No remedy was efficacious against tapeworms in poultry. Of the four drugs tested, chenopodium gave the best results for this purpose, but its efficacy for tapeworms is very slight.

"Turpentine proved the most efficacious of the remedies tested on poultry for the removal of *Ascaridia perspicillum*, while chenopodium was nearly as good. When tested on dogs and pigs, turpentine was not very efficacious; and, as it caused grave symptoms of nephritis in pigs and caused the death of some of the experiment dogs, its use upon these animals is inadvisable.

"The treatment with chopped tobacco stems recommended by Herms and Beach for ascarids in poultry proved fairly efficacious for *Heterakis papillosa* and would presumably be at least as efficacious for *Ascaridia perspicillum*, since this latter worm is more easily reached by anthelmintics than is *H. papillosa*.

"There are a large number of drugs showing a greater or less degree of efficacy for the various intestinal parasites of domestic animals. Usually their action is selective—that is, they show a pronounced efficacy for certain species of intestinal worms, while they are decidedly less efficacious or entirely inefficacious against other intestinal parasites. If we consider the ideal anthelmintic one which will remove all worms of a given class or species, and do this every time in a single dose, we find that very few drugs approach this ideal.

"Among the drugs which have given the best results under experimental conditions for the purposes intended and concerning which the writers have sufficient data to warrant positive conclusions may be mentioned the following:

"(1) Copper sulphate in drench for stomach worms in sheep.
"(2) Oil of chenopodium for ascarids in pigs and dogs.
"(3) Oleoresin of male-fern for tapeworms in dogs.
"(4) Turpentine for *Ascaridia perspicillum* in fowls.
"(5) Chopped tobacco stems for *Heterakis papillosa* in fowls."

GILCHRIST (J. D. F.). **The Life-History of *Distoma luteum* n. sp. With Notes on Some Cercariae and Rediae found in S. Africa.** —*Parasitology*. 1918. Apr. Vol. 10. No. 3. pp. 311–319.

Although fluke disease in sheep is very common in certain parts of South Africa the intermediate host of the parasite has not been recognised. The fresh water snail (*Limnaea truncatula*) which is the intermediate host in Europe has not been recorded with certainty in South Africa. The commonest fresh water snail there is *Physa* (*Isidora*) *tropica* and this mollusc harbours in great abundance stages of fluke very closely resembling those of the liver fluke, the important difference, however, being that even when placed in the most favourable conditions the free-swimming form (cercaria) was never observed to encyst.

The author's investigations proved that the forms found in this snail were in reality stages in the life cycle of a small fluke commonly found in the alimentary tract of the frog in South Africa. The adult form was very similar in appearance to *Distoma echinatum*, and on account of its colour it is named by the author *D. luteum*.

The problem as to the life cycle of the South African liver fluke thus still remains unsolved.

EPIZOOTIC LYMPHANGITIS.

BOQUET (A.) & NÈGRE (L.). **Culture du parasite de la lymphangite épizootique et reproduction expérimentale de la maladie chez le cheval.** [The Cultivation of the Causal Organism of Epizootic Lymphangitis and Reproduction of the Disease Experimentally in the Horse.]—*C. R. Acad. Sci.* 1918. Feb. 18. Vol. 166. No. 7. pp. 308–311.

In spite of the researches of TOKISHIGE, MARCONE, and SAN FELICE, who have published the results of attempts at cultivating the cryptococcus held to be the cause of epizootic lymphangitis some doubt still existed on the nature of the parasite, for during recent years certain authors have described it as a protozoon. One of the authors in collaboration with BRIDRÉ (1910) showed that the cryptococcus behaved in the same manner as one of the Blastomycetes in the deviation of the complement test. In this article the mycotic nature of RIVOLTA'S cryptococcus is demonstrated by its development in mycelial form in sub-cultures and by the reproduction of the disease experimentally by inoculation of these cultures into a horse.

The cryptococcus was cultivated on horse-dung agar covered with a film composed of macerated lymphatic gland pulp from a horse [see this *Bulletin*, Vol. 5, No. 2, p. 116]. After sub-cultivating two or three generations the addition of the latter material became no longer necessary. The authors succeeded in transplanting these cultures on to Sabouraud's agar, potato, and carrot, and in this way obtained up to the 12th sub-culture on all these media.

Positive results were obtained in the deviation of the complement test with the serum of infected horses when the above cultures were used as antigen.

In two cases the disease was set up in the horse by subcutaneous inoculation of cultures in the regions of the poll and the shoulder. The first experiment was performed by inoculating colonies from a first sub-culture, still containing cryptococci, and the second with colonies from an 8th sub-culture obtained from a strain isolated 11 months previously.

At the seat of inoculation there appeared 24 hours after injection a large oedematous swelling which disappeared in 5 or 6 days. A small nodule which remained stationary was then left and in three or four weeks this firm nodule of fibrous consistency commenced to become enlarged. It then contained cryptococci apparently smaller in size than ordinary crytococci and without a double envelope.

The nodule become softened in some instances and discharged a pus containing typical cryptococci which were all enclosed within leucocytes. The lesion then became sometimes cicatrised and arrested in its development.

In other cases after or without partial abscess formation the fibrous nodule increased in size and a corded lymphatic with nodules distributed along its course then arose from it. This generalisation did not appear until the sixth or seventh week after inoculation. The corded lymphatic developed as in the case of the natural disease.

Inoculation of material intra-cutaneously or on to the scarified shaved skin gave rise only to localised abscesses containing cryptococci.

The first horse that had been inoculated and had recovered from the infection remained refractory to subsequent inoculations whilst a control horse inoculated at the same time with the cultures contracted the disease. Vaccination and bacteriotherapy by means of heated cultures are in course of investigation.

LINDNER (P.) & KNUTH (P.). **Untersuchungen über einen im Eiter eines an der epizootischen Lymphangitis erkrankten Maultieres gefundenen Pilz (*Monilia capsulata*).** [Researches with regard to a Mould (*Monilia capsulata*) found in the Pus of a Mule Affected with Epizootic Lymphangitis.]—*Ztschr. f. Infektionskr. d. Haustiere.* 1916. Vol. 17. No. 5. pp. 290–308. With 2 text-figs. & 4 plates comprising 24 figs.

In a number of smears of epizootic lymphangitis pus received in 1911 from German East Africa and kept in the laboratory for from six to eight months Knuth succeeded in obtaining colonies of mycelial growth on planting the material on prune agar. A further detailed study of the growth obtained from Knuth's cultures and from the still living organisms in the smears was then carried out by Lindner, who figured the sprouting of mycelial threads with clusters of moniliform encapsulated elements attached to them on incubation at temperatures below body temperature. Knuth, however, failed to set up appearances resembling those of naturally occurring epizootic lymphangitis after inoculation of large quantities of the growth into susceptible horses.

BACTERIAL DISEASES.

VINCENT (H.). **Sur la prophylaxie de la Fièvre de Malte par l'immunisation active des animaux vecteurs du germe.** [Prophylaxis of Malta Fever by Active Immunisation of Animals acting as Carriers of the Causal Organism.]—*C. R. Acad. Sci.* 1918. Feb. 25. Vol. 166. No. 8. pp. 359–362.

"Although it was originally considered as a disease confined to Malta and Gibraltar, Malta fever is in reality observed in a large number of countries, especially those bordering on the Mediterranean Sea. It is by no means rare in France where it has given rise to veritable epidemics (Cantaloube, Friley).

"It would certainly be erroneous to consider the goat as the principal reservoir of the Malta fever virus (Zammit, Horrocks, Kennedy, Shaw, etc.), since other animals are capable of becoming infected in the same way and are therefore contagious for man. Nevertheless it appears from the numerous works published on the subject that the goat holds chief place as etiological factor of the disease.

"On account of the economic importance of goat breeding it appeared that the publication of the result of investigations on the prevention of Malta fever by active immunisation of the animals susceptible to this disease would prove of value. Anthrax, which formerly caused great ravages among stock and became transmitted by the latter to man has become rare in both instances since the application of anti-anthrax vaccination to herds of cattle and sheep according to the rules prescribed by Pasteur.

"One is led to believe that active immunisation of the goat against *Micrococcus melitensis* is capable of realisation, for this animal in most cases only presents very slight morbid symptoms although it may harbour the causal organism for a long time in its urine and milk. Moreover, the goat may recover spontaneously after a varying interval. After recovery it has acquired immunity (Bruce). It was thus attempted to increase this natural resistance by means of vaccination with several strains of *M. melitensis* (Vincent H. and Collignon, 1910).

"Immunisation of animals by means of living virus, even if it has been attenuated, cannot be undertaken inasmuch as one would produce cases of infection and would thus facilitate the dissemination of *M. melitensis* through the agency of these carriers of the organism. It thus becomes necessary to vaccinate them with a dead virus.

"Agar cultures three or four days old were diluted in normal saline solution, then sterilised by shaking with ether and left in contact with this liquid for two hours. A thick oily layer is formed on the surface which is thrown away. Only the underlying emulsion is utilised.

"The vaccine is polyvalent. It is at present prepared with 10 strains of *M. melitensis* and one strain of *M. para-melitensis* forwarded by Edmond Sergent (from Algeria) and Moragas (from Barcelona). . . . The vaccine contains about two thousand millions of the micrococci per cubic centimetre. Two doses of 2 c.c. each are injected at 5 or 8 days interval.

"The following experiments were made in order to obtain proof of the degree of immunity conferred by these injections. A first lot of two adult goats was vaccinated, in 1910, after ascertaining that the blood possessed no agglutinating properties. One received 3 c.c. and the other 4 c.c. of the vaccine subcutaneously three times and at 8 days interval. A month afterwards a 4 c.c. dose of living virulent culture was injected into the jugular vein.

"These test injections of large doses of the living organism only brought about a slight increase in temperature. The fever disappeared on the following day. The second goat had transient diarrhoea. Both animals remained in an absolutely normal state of health and fattened considerably. Their blood was sown out on culture media on two occasions, viz., 8 days and 1 month after the test inoculation, but no growth was obtained. The second goat became pregnant four months afterwards and gave birth to two perfectly healthy kids at full term.

"Two young he-goats 6 and 8 months old, respectively, were immunised by single *intravenous* injection of 2 c.c. of vaccine; subsequently they showed only a slight febrile reaction. In order to test their immunity they were injected four weeks afterwards into the jugular vein with 4 c.c. of living virulent culture. This test injection gave rise to more distinct reactions than in the case of the she-goats vaccinated by subcutaneous inoculation. The two goats had a temperature of 40° C. with slight diarrhoea and inappetence. Nevertheless these symptoms did not persist and their growth afterwards took place normally. Blood and urine from them sown out on media three and six weeks afterwards did not give rise to a growth of *M. melitensis.*

"Another adult she-goat and two kids, 2 and 3 weeks old, respectively, were vaccinated by means of double injections. One month afterwards the whole of a three-day-old growth from a slope agar tube was inoculated intravenously into the she-goat and the same quantity of living virus was inoculated intraperitoneally into the two kids. Two months afterwards the two kids were fed for a week with food material mixed with *M. melitensis.* All three animals remained immune. The she-goat was killed after a month's interval and the two kids were killed, one after 3½ months and the other after 9 months, the animals having been kept off food for a day before slaughter. Heart blood, spleen pulp, liver pulp, bile, kidney tissue, urine, and bone marrow (femur) sown out on culture media remained absolutely sterile.

"It is known that in the case of goats experimentally inoculated by subcutaneous injection *M. melitensis* may be found in the internal organs for one year or even 16 months afterwards (Zammit).

"The preceding experiments thus show that the vaccinations set up in the goats a powerful immunity which protected them against a very large dose of the virus introduced subcutaneously, intravenously, intraperitoneally, or by the digestive tract.

"By this method . . . more than 200 young or adult goats were vaccinated; also the goats of the Natural History Museum, Paris, were treated in the same way in 1910 and 1911. After a preliminary examination of the blood and after demonstrating that it had no agglutinating power towards *M. melitensis* vaccination was performed (1) on adult he- or she-goats; (2) on kids from 2 to 3 months old; (3) on goats from the first to the third month of pregnancy; (4) on milch goats. The vaccination did not produce any noteworthy symptom. The injections led, a few hours afterwards, to a rise in temperature of 0.5 to 1.0° C; the following day the temperature was normal, the goats maintained their appetite; pregnant animals did not show any morbid symptom and subsequently parturition in these animals was absolutely normal.

"By the application of these measures for immunising goats and other animals capable of transmitting Malta fever through their milk or milk derivatives or even by direct contagion one is thus enabled to protect both these animals and indirectly man himself against that grave disease."

LISTON (W. Glen) & SOPARKAR (M. B.). **The Susceptibility of Indian Milch Cattle to Tuberculosis.**—*Indian Jl. Med. Res.* 1917. July. Vol. 5. No. 1. pp. 19–71. With 2 tables, 22 charts, 3 plates & 18 coloured full-page charts and diagrams.

According to the opinion of a large number of observers bovine tuberculosis is of rare occurrence in India although in certain localities it has, however, been lately shown to affect quite a considerable proportion of the cattle population as, for example, in the Punjab [see following extract]. The comparative rarity of the disease in India has been attributed by many to the proportionally greater open-air life of Indian cattle than of European and American cattle. This explanation, however, does not apply to cattle housed in a large city like Bombay, where, according to recent reports, there are about 43,000 cattle housed in byres or cattle sheds. The freedom from tuberculosis of these cattle might be attributed to a relatively greater resistance to the disease than is the case with European or American cattle. The experiment described in this paper was performed with the object of testing this assumption and hence the plan adopted was to inject native cattle subcutaneously with large and small doses of bovine tubercle bacilli and compare the effects produced with those obtained in the case of English cattle similarly treated. It is unfortunate that the authors did not find it possible to utilise a number of imported European cattle for control purposes in their experiment, but inasmuch as the work could not be carried out under such rigorous conditions a strain of bovine virus which was used in the experiments of the English Royal Commission on Tuberculosis was obtained from Dr. EASTWOOD, one of the workers under that Commission. Cultures of this strain were found to be highly virulent for rabbits.

Fifty milligrammes of culture of the bovine organism is known to produce almost invariably in English cattle a generalised progressive tuberculosis, while 10 milligrammes often brings about a fatal result. Twelve buffalo and 12 cow calves from four to eight months old were thus inoculated subcutaneously in front of the shoulder with virulent culture; in each of these two lots of animals six received 50 mgms. and the other six 10 mgms. A buffalo calf and a cow calf purchased at the same time were not inoculated but left to serve as controls. The buffalo calves were in a weakly condition at the time of inoculation and the control animal died on the day after the experiment began.

In their protocols the authors record the changes occurring at the seat of inoculation, the condition, body weight, and daily temperatures of the animals throughout the course of the experiment. The results of the post-mortem examinations after natural death or slaughter are also given and elaborate figures are drawn to illustrate the distribution of the lesions in the Indian calves as compared with those described in the case of English calves experimented on under similar conditions, as detailed in the Reports of the English Royal Commission on Tuberculosis.

The authors summarise their results as follows:—

"While the experiments of the Royal Commission on Tuberculosis show that, with rare exceptions (1 out of 35), all English calves die of acute tuberculosis when inoculated with 50 mgms. of a culture of bovine tubercle bacillus, our experiments prove that at least 50 per cent. (6 out of 12) of Indian calves, whether they be buffalo or cow calves, live for many days after a similar dose of culture of the bovine bacillus and when killed show only retrogressive or healing tubercular lesions.

"The experiment confirms the general experience that Indian cattle are less commonly affected by tuberculosis than English cattle are, and supports the view that the comparative infrequency of the disease among cattle in India is due to a natural resistance rather than to any method of housing or keeping cattle in India as compared with England.

"Nevertheless certain Indian calves seem to die as quickly from generalized tuberculosis, after the subcutaneous injection of even 10 mgms. of culture, as English calves do, so that there is a considerably greater individual variation in susceptibility to infection by the tubercle bacillus among Indian as compared with English calves. Whether this variation be associated with differences in the breeds of the calves used by us has not yet been determined. It, however, follows that the comparative rarity of tuberculosis in Indian cattle must in part at least be attributed to diminished opportunities for acquiring infection.

"The possible existence of tuberculosis among certain imported breeds of cattle and their liability to contract tubercular infection is therefore a source of danger to indigenous herds. One out of three definite cases of tubercular disease in cattle in India which came under our observation was found in an English bull which had been kept at the Allahabad Military Dairy Farm. Attention should be paid to this point when attempting to develop a more useful milk-yielding stock than is at present available among the indigenous breeds.

"It remains only to draw attention to another important point. On account of the constancy with which a dose of 50 mgms. of a culture of tubercle bacillus of bovine type causes acute generalised tuberculosis when injected subcutaneously into calves, this method has been recommended by all great workers in Europe and America, as a means of distinguishing between tubercle bacilli of typus bovinus and typus humanus. Our experiments prove that, when using Indian breeds of cattle at least, this test cannot be relied on, for in 50 per cent. of the calves the effects produced by such an inoculation do not materially differ from the effects produced by the injection of a similar dose of tubercle bacillus of typus humanus in English cattle.

"Incidentally our experiment sheds some light on the practical absence of tuberculous lesions caused by the bovine type of bacillus in children and adults in India. This is a subject which will be discussed in a subsequent paper."

TAYLOR (G.). **Note on the Prevalence of Bovine Tuberculosis in the Punjab.**—*Indian Jl. Med. Res.* 1918. Jan. Vol. 5. No. 3. pp. 497–509. With 1 table.

Hitherto tuberculosis in cattle has not attracted much attention in India, the general idea being that the native cattle are comparatively free from the disease. This idea, however, appears to be erroneous according to the data furnished by Taylor in this paper, which is based upon observations recorded subsequent to the institution of a proper system of meat inspection at Ferozepore Cantonment slaughterhouse, Southern Punjab.

The enquiry was carried out from August 1915 to March 1916, during which period 3,276 animals were admitted for slaughter. These animals had arrived almost entirely from the Central and South-Eastern districts of the Punjab, and were all of the indigenous breed. The method of meat inspection entailed the examination of all animals while still alive, and thus 575 of the above animals, or 17·8 per cent., were rejected as not likely to be fit for human consumption on account of innutrition, disease, or old age. It is probable that a good many of these cast animals were suffering from chronic tuberculosis. Of the remaining selected animals 95, or 3·5 per cent., presented after slaughter what appeared to be macroscopic tuberculous lesions. In 60 of these cases tubercle bacilli were demonstrable in the lesions on microscopic examination. The distribution of the lesions in each of the affected animals is depicted in tabular form. The animals found to be tuberculous were all females; this would be due to the fact that cows and heifers form by far the largest source of meat supply. The lesions in the selected cattle were nearly all of a localised nature. In all but two cases the disease was confined to the thoracic cavity. The bronchial and mediastinal glands were most commonly affected either alone or associated with invasion of the lungs. In many cases the lesions were so limited in extent that they were only discovered after very careful search. In the two cases mentioned above there were lesions in the mesenteric glands in addition to those in the thoracic cavity. In only one case was anything like a generalised condition of the disease found, viz., in a cow about 9 years of age. This was the only case in which the udder was affected.

During the year 1916–1917 (1st April–31st March), 4,610 animals were brought for slaughter. Of these 821, or 17·8 per cent., were rejected as unfit for slaughter. Of the remaining animals, which were slaughtered, 125, or 3·3 per cent., were found infected.

The above figures appear to indicate that tuberculosis is by no means uncommon in the Punjab. With regard to the prevalence of the disease in India it is a striking fact that hitherto practically all the cases recorded have been confined to Northern India, the Southern Provinces apparently being free. Further investigation on this subject is required.

DISEASES DUE TO FILTERABLE VIRUSES.

Howard (C. W.). **Insect Transmission of Infectious Anaemia of Horses.**—*Jl. Parasit.* 1917. Dec. Vol. 4. No. 2. pp. 70–79.

In natural circumstances equine infectious anaemia appears from the result of experiments to be transmitted most likely by blood-sucking flies and thus investigators have in the course of the last ten years endeavoured to ascertain the species capable of acting as transmitting agents. The Japanese Commission (1904), as the result of a series of careful experiments with various insects, emitted the opinion that tabanids were probably the vectors, in view of their great numbers and violent attacks upon horses in affected localities, and also the seasonal occurrence of the disease coincides in Japan with the appearance of the flies. The Commission was, however, unable to handle the flies successfully and so no experiment was tried with them. K. R. & R. Seyderhelm (1914) incriminated bots. Swingle (1914) in Wyoming obtained negative results in his experiments with tabanids but suggested the possibility that the blood voided from the wounds caused by these flies might spread the disease after ingestion; these investigations in Wyoming were continued by Scott who concluded that *Stomoxys calcitrans* was the carrier in that district.

The author's work commenced in the spring of 1915 at the Minnesota Experiment Station in co-operation with the United States Bureau of Animal Industry. A careful survey of the biting insects in the areas infected with swamp fever was first made.

In order that a suspected insect might act as transmitting agent of swamp fever in an affected locality it was laid down that it should be found over a very wide area within that district, be a ready feeder on the horse, and able to pass rapidly from one horse to another. The fact also that swamp fever in Minnesota usually begins to appear in July and increases in severity in August, while the incubation period is from 10 to 30 days, "made it appear that the early spring breeding forms were more likely to be the carriers."

Ticks could be eliminated as probable vectors inasmuch as they were not abundant in the affected localities. Species of simuliids were present and appeared early in the season but not so early as the tabanids and were not present in all parts of the State. Mosquitoes were present everywhere, both inside stables as well as in pastures and certain species appeared early in spring. It has been shown that stable infection is rare and also if mosquitoes were responsible for the transmission of swamp fever it would probably be more widely epizootic. The same applies to the stable fly, *Stomoxys calcitrans*, but it is not abundant in early summer and in that respect does not coincide with the requirements set for possible vectors.

Several species of tabanids appeared in spring and early summer, and in these seasons they appeared as early as the end of May but never later than the beginning of July. The early tabanids were the worst insect pests of horses and cattle in the northern half of the State where much of the land is still virgin timber or swampy in character. These facts concerning the flies seem to fulfil the conditions laid down above and it was decided to begin work with them.

The author then briefly describes experiments in which large numbers of tabanids were brought from the infected areas to the laboratory in an endeavour to induce them to feed on infected and susceptible horses kept separately in wired cages. It was only possible to keep a very few specimens alive for this purpose. A horse known to have been infected for four years was kept in a cage adjacent to one containing a susceptible horse and separated by a double partition of half-inch mesh wire netting. One end of the apartment was cut off from the rest by a partition of insect proof netting for the purpose of containing a control horse. Tabanids were allowed to feed alternately on the infected and susceptible horse for 18 days and during the following 80 days no rise in temperature was noted in the latter animal. It was then inoculated with virulent material and shown to have been highly susceptible.

In the course of the following year an experiment was carried out in somewhat the same manner with *Stomoxys calcitrans*. The feeding of the flies lasted 42 days and 44 days later, blood was taken from the susceptible horse, when it had to be destroyed on account of an accident, and inoculated into another susceptible horse. The latter animal commenced to react 23 days later and death occurred 89 days after the injection; filtered blood from this horse reproduced the disease in another susceptible horse.

> "From this experiment it seems probable that swamp fever of horses *can* be carried from one horse to another by the biting stable fly, *Stomoxys calcitrans*.
>
> "The results of these experiments, together with a study of the investigations of other workers has not, however, fully convinced us that insects are the usual or only carriers of the disease."

Cornwall (J. W.) & Menon (T. Kesava). **On Experimental Immunization against Rabies by the Method of Phisalix.**—*Indian Jl. Med. Res.* 1917. Apr. Vol. 4. No. 4. pp. 688–690.

In 1915 Phisalix described how rabbits treated intravenously with a solution of the cutaneous mucoid secretion of salamanders, *Siredon mexicanus* or *Rana temporaria*, followed by, or mixed with, a solution of the venom of *Vipera aspis*, which had been heated to 75° C. to reduce its toxicity, resisted subsequent subdural inoculation with the fixed virus of rabies. This observation appeared to the authors to be of sufficient importance to justify them in repeating the experiments with the materials at hand in India. The technique indicated by PHISALIX was followed as closely as possible, the cutaneous mucoid secretion of *Rana limnocharis* and *R. tigrina* being substituted for that of *R. temporaria*, and the venom of *Daboia russelli* for that of *Vipera aspis*. A series of experiments in which rabbits were inoculated with the cutaneous secretions of these Indian frogs and a dose, just below the minimum lethal dose, of the heated venom of the fairly common Indian viper and, subsequently, were given a test inoculation with fixed rabies virus gave uniformly unsuccessful results. Further, these results did not encourage the authors to believe that success might follow if other combinations were tried, i.e., the secretion of other frogs or the venom of other vipers.

CORNWALL (J. W.). **A Note on the Occurrence of Negri Bodies.**—*Indian Jl. Med. Res.* 1918. Jan. Vol. 5. No. 3. pp. 478–480.

"It has been held that it would be possible to decide by microscopical examination of the brain of a man, who had died from hydrophobia after undergoing a course of anti-rabic inoculations, whether death had been due to the street-virus originally introduced by the bite or to the fixed-virus used in the treatment; death from street-virus would be denoted by the presence of large Negri bodies, from fixed-virus by the absence of Negri bodies, except perhaps a few minute dots. The point is of mere academic interest in India, for fixed-virus in the living state is not used in the treatment." The author then summarily describes the results obtained from a considerable number of experiments performed on guinea-pigs, dogs, and rabbits at the Pasteur Institute of Southern India. From the observations thus made the author summarises his results as follows:—

"(1) Numerous and large Negri bodies invariably occur after (a) subdural inoculation with street-virus brain matter, (b) subcutaneous inoculation with street-virus salivary gland matter, when the latter has proved virulent;

"(2) scattered and minute Negri bodies may sometimes be found after numerous subdural passages in one and the same species;

"(3) scattered, but fairly large Negri bodies may sometimes be found if the fixed virus of one species be subdurally inoculated into another species;

"(4) after subcutaneous inoculations of street-virus brain matter—(a) large and numerous Negri bodies seldom occur, (b) small and numerous Negri bodies often occur, (c) often no Negri bodies at all can be found;

"(5) after subcutaneous inoculations of fixed-virus brain matter, minute Negri bodies may sometimes be found."

EAST AFRICA. **Rinderpest in East Africa.** [BY GRAY (C. E.).] MSS. Reports received in Colonial Office, dated 1917. May 25 & July 26. 25 pp. f'cap. With 1 map.

In these reports an account is given of the measures taken to prevent the extension of rinderpest in a southward direction from German East Africa into the Nyasaland Protectorate and Northern Rhodesia. The area in which operations were undertaken embraced the region lying just north of the boundary, that is between the northern end of Lake Nyasa and the southern end of Lake Tanganyika and south of the Livingstone range of mountains and Lake Rukwa. Before the arrival of the expedition for the control of the disease under Colonel Gray the Nyasaland and Northern Rhodesian authorities set up a barrier against the rapid spread of the disease southwards by removing all cattle from a belt 10 to 20 miles wide south of the German boundary. A few outbreaks had been located south of the Livingstone range and thus it was resolved to clear the disease from the affected localities by the adoption of simultaneous inoculation methods and also immunise by the same method all cattle running in a belt of country about 35 miles wide lying north of the German boundary.

Inoculation camps were thus established at various places in order to carry out this plan but at first the disease appeared to show a tendency to die out naturally, and the native cattle of the districts affected appeared to possess a high degree of natural immunity. Moreover, the experience gained at the inoculation camps showed that certain complicating factors of a somewhat serious character had to be reckoned with when working on a large scale, which were not anticipated when the establishment of a belt of immune cattle along the southern border of this territory was originally contemplated. The original scheme was thus abandoned and instead of it measures were taken to guard the New Langenburg district against the introduction of disease from the other side of the Livingstone range where rinderpest is always more or less enzootic. The most important complicating factor was the appearance of a large mortality from East Coast fever among the cattle collected at the concentration camps. The mortality from this disease did not begin until the animals had been inoculated with rinderpest blood and serum, and, although the occurrence of ordinary redwater as a complication in outbreaks of rinderpest, where the vitality of the animals has become depressed owing to the inoculation, is well recognised, a similar phenomenon has not yet been proved to take place in the case of East Coast fever. Inoculation experiments were thus carried out in order to elucidate this problem and these "appeared to show that such complications were likely to occur, although the mortality therefrom might be negligible, most of our animals showing microscopic evidence of the revival of East Coast fever infection by the appearance of Koch's bodies in their blood whilst undergoing reaction to rinderpest inoculation. None of these died, however, although several control animals inoculated at the same time with rinderpest virus alone and unprotected with serum succumbed after showing during the course of their illness that East Coast fever organisms had again become active."

These experiments appear to prove that the bad results obtained at one of the concentration camps (Old Utengule) were chiefly due to the movement of cattle susceptible to East Coast Fever into an area where that disease was enzootic, for purposes of inoculation, rather than to a serious breakdown in the immunity of animals reared on East Coast fever veld. The records of the German authorities pointed to a very high mortality from East Coast fever among the cattle of this district.

However, as the result of the inoculation rinderpest appeared to have been brought speedily under control. Investigations were then carried out to ascertain the prevalence of rinderpest immediately north of the Livingstone range of mountains and towards Lake Rukwa and determine whether the mountains could serve as an efficient barrier against the southward spread of the disease. Only one small outbreak was detected and this was dealt with by serum inoculation. Elsewhere the disease appeared to have died out.

Unfortunately, however, in the meantime rinderpest re-appeared in the New Langenburg district south of the mountains and the history of the outbreak showed that it had originated owing to the unauthorised movement of cattle while undergoing a reaction subsequent to inoculation and it assumed serious dimensions owing to the concealment by the natives of the first cases that occurred. This was dealt with by the use of serum alone but later a number of other outbreaks were detected and work had thus to be resumed by adopting the simultaneous method of inoculation and carefully guarding the area in which operations were undertaken.

Gray then adds a few remarks upon the methods employed where large numbers of cattle had to be inoculated in order to effect economy of time and labour with least fatigue to operators working under a tropical sun. The short crush method adopted by GARDEN (G.) was found to answer this purpose best.

> "In the short crush method a crush capable of accommodating two animals only is erected, width at bottom being twelve inches, the uprights inclining outwards at an angle which increases the width to two feet six inches, at a height of three feet above the ground. The crush is provided with two sets of slip rails, the one set at the exit from the crush, the other set five feet six inches further back, there being a stout post sunk in the ground in front of the exit, round which the head rope can be hitched in the event of an animal proving refractory. The animals are roped individually in the kraal connected with the crush by the owner, the rope is passed forward along the crush, the head drawn up to the front slip rails and held there by three or four boys, while the slip rails are put in behind it. The inoculators stand one on either side of the crush, and as the animal is secured, they inoculate it simultaneously, brand it, liberate it, and stand ready for the next. With tractable animals and natives who handle the ropes and bring the animals forward quickly, it has been found possible for four operators working at two crushes, to inoculate over eighteen hundred head in a day with much less effort than would be required to handle a similar number by casting them and walking from one animal to another."

Over 11,000 cattle were inoculated at the two new stations; the reactions in many cases were well-marked and although fatal cases were observed in which East Coast Fever infection had apparently been revived by inoculation the mortality due to inoculation was not more than one half per cent. Two or three small centres were found which were stamped out by the use of serum alone.

Unfortunately again, however, rinderpest made its appearance close to the Nyasaland border owing to the movement of a couple of calves out of an infected area by a native headman. This fresh focus of infection lay in the centre of a district containing about 20,000 head of cattle and situated around a route of considerable military importance. Mention is made at the close of the report that the work of inoculating all cattle in the belt of country involved by this fresh outbreak had just been completed and the author then entertained the hope that there was a fairly good chance of keeping the disease out of Nyasaland, especially as intercourse with that country had been entirely stopped along the Songwe on account of the presence of bubonic plague at Karongo on the other side of the river.

The work had to be carried out under difficulties owing to the diminished number of personnel due to sickness and military requirements.

MOUSSU (G.). **La peste bovine en Afrique occidentale française.** [Rinderpest in French West Africa.]—*Rec. Méd. Vét.* 1918. March. 15. Vol. 94. No. 5. pp. 105–114. With 1 map.

In the vast extent of territory comprising French West Africa the bovine population amounts to about 6,000,000 head. With proper organisation a very large quantity of meat would thus be available for importation into France. However, according to Moussu, the French authorities in the past have been extremely slow to realise the possibilities of this Colony. Largely at his own instigation a factory was constructed at Lyndiane in Senegal, and from this centre alone 30,000 head of large cattle were exported to France in 1916. Lack of economic organisation appears to constitute the chief cause of the smallness of output of meat for exportation from the Colony. In addition the French authorities have neglected to provide an adequate veterinary service for combating outbreaks of contagious disease. Only nine veterinarians are available for this purpose for the whole tract of immense territory comprising Senegal, Upper Senegal and Niger, Dahomey, Guinea, Mauritania, and the Ivory Coast.

No serious outbreaks of disease have occurred until recently since the years 1891–1893, when rinderpest caused great ravages among the cattle population with the result that a good many breeding centres have not recovered from its effects to this day. Central Africa constitutes a reservoir for the maintainence of rinderpest whence it is liable to spread to the east or north east into Egypt and Eritrea or towards the west into French Soudan, Dahomey and Senegal. The Sahara Desert forms an efficient barrier against its spread into the French possessions along the Mediterranean coast. Moussu quotes reports dealing with the re-appearance of serious outbreaks in various centres from 1915 to 1918, and with the spread of the disease the mortality rate has gradually increased in certain places from 25 per cent. in 1915 up to 90 per cent. more recently. Moussu pleads for the installation of a series of serum stations together with a veterinary organisation for the control of further outbreaks.

BOYNTON (William Hutchins). **Experiments on the Treatment of Rinderpest with Various Drugs.**—*Philippine Agric. Rev.* 1917. Third Quarter. Vol. 10. No. 3. pp. 272–298. With 1 plate.

The drugs used in these experiments were as follows :—(1) eosin ; (2) medicinal methylene blue (Merck) ; (3) cacodylate of soda ; (4) atoxyl ; (5) quinine sulphate ; (6) camphorated oil ; (7) creolin ; (8) permanganate of potash ; (9) ergot ; (10) iodine ; (11) potassium iodide ; (12) gentian violet ; (13) arecolin hydrochloride ; (14) nuclein ; (15) formalin ; (16) chlorazene ; (17) castor oil ; (18) alcohol ; (19) fluid extract of nux vomica ; and, (20) fluid extract of gentian.

The work was carried out by Boynton at the Laboratory of the Veterinary Division, Bureau of Agriculture, Philippine Islands, and extended over a period of about six and a half years. Altogether 47 experiments were performed, which are carefully described. From the results obtained the author holds that no curative effect could be observed after the use of any of the above drugs in the doses and methods adopted for administration.

Specific cures for rinderpest had been claimed by many people in the course of treatment of outbreaks in the field but statistics showed that in many localities the recoveries of animals under normal conditions were very high, averaging in many instances about 60 per cent. The so-called cures would also undoubtedly have been administered to selected cases in the scene of an outbreak, and this would account for the high percentage of recoveries claimed. Moreover, when these drugs were given a proper trial they were invariably found lacking in curative powers. The drugs tested in the author's experiments were in nearly all cases injected into animals infected with a highly virulent rinderpest strain maintained at the laboratory in connection with the manufacture of anti-rinderpest serum.

However, "Stanton YOUNGBERG, Chief Veterinarian, Bureau of Agriculture, and the several veterinarians in charge of the immunization stations in the province have been using strychnine, nitroglycerin, and echinacoid, on animals which have a severe reaction while passing through the immunization. (Simultaneous method, receiving an infecting dose of V.B. and a supposedly protecting dose of anti-rinderpest serum on the same day or within one or two days of each other.)

"These workers find that all three of the above-mentioned drugs prolong the life of animals by their stimulating effect and in many instances seem to sustain life long enough for the animal to develop sufficient antibodies to combat the disease and in this way make a recovery. They find that when using strychnine great care has to be taken in not stopping the use of the drug too suddenly as its action is very transient and if not administered at short intervals the animal is apt to suffer collapse and die suddenly.

"Although these drugs are practically useless for animals which contract rinderpest in the usual way and have not previously received a protecting dose of serum, the results would indicate that they might be used on animals that have severe reactions while being immunized."

BOYNTON (William Hutchins). **Preliminary Report on the Virulence of Certain Body Organs in Rinderpest.**—*Philippine Agric. Rev.* 1917. Fourth Quarter. Vol. 10. No. 4. pp. 410–433.

Boynton states that from many observations made in his laboratory during the past seven years it had been noticed that the virus of rinderpest was quickly destroyed in decomposing material, either tissue or blood. On the other hand if virulent blood was drawn under aseptic conditions and placed in sterile containers the virus retained its activity for five or six days. If the blood is kept in a clotted form the virus retains its activity for a few days longer. In a previous work (1913) it was shown that when the large water leech (*Hirudo boyntoni* Wharton) was allowed to feed upon an animal suffering from rinderpest the virus might remain active for a period of 25 days in the body of the leech. In this case the blood was kept free from putrefactive organisms and also in a semi-anaerobic condition.

From a study of the symptoms and lesions in rinderpest the author maintains that the virus affects primarily the involuntary muscles and endothelial lining of the capillary vascular system and the parenchymatous tissue; this is prominently demonstrated in the intestinal tract and in the lymphatic system on histological examination. Further, from the results obtained by intravenous injections of various drugs and disinfectants it is held that the seat of multiplication of the virus is not in the blood stream but inside the tissue cells where the disinfectants cannot penetrate, the virus in the blood stream being merely a surplus which is thrown off by these tissue cells.

In this paper the author details the results of experiments performed with the object of determining the virulence for certain organs after extraction with weak phenol solutions in order to keep down the activity of putrefactive organisms to a minimum while the drug had little or no effect upon the virus of rinderpest. The technique adopted was as follows:—

> "The tissues were taken from the animal as soon after death as possible. The amount of tissue desired was weighed, and ground in a meat grinder which had been previously sterilised in the autoclave to keep external contamination down to the minimum. The material thus prepared was placed in a sterilised flask and twice as much phenol solution (the strength of the solution is mentioned in the case of each experiment) was added. Both crude phenol and the pure crystal form were used in these experiments with similar results, i.e., 100 grammes of liver was ground and placed in a sterile flask and 200 cubic centimeters of a 0·5 per cent. phenol solution added to it. This material was thoroughly agitated two or three times a day and kept in the refrigerator which averages between 15° and 16° Centigrade. In some experiments the material was placed in a shaking machine and agitated continuously for 48 hours at room temperature which averages 26° Centigrade in the morning and 28° Centigrade in the afternoon, some days rising to 30° Centigrade. After the 48 hours of agitation at room temperature the material was placed in the refrigerator for 24 hours and then filtered through gauze to separate out the coarse material and the filtrate replaced in the refrigerator until used.
>
> "When the intestines were to be extracted they were first thoroughly washed free from fecal matter, then placed in a 0·5 per cent. phenol solution for from five to ten minutes after which they were placed in a large container of boiled water which was cooled down to at least 37° Centigrade. The tissue was allowed to soak in this water for a few minutes to dilute the phenol which remained intact. By this method a greater percentage of the bacteria on the surface of the intestinal mucosa were destroyed. Following this treatment the tissue was weighed, passed through the meat grinder, and treated in a similar manner to the other tissues."

The animals used in the experiments were all highly susceptible cattle and carabaos, and had been obtained from localities known to be free from rinderpest for a considerable number of years. These animals were brought into the laboratory and kept under observation for certain lengths of time, their temperatures during this period being taken twice a day and their general appearance noted. While under experimentation and until the first symptom of disease appeared the animals were kept in an isolation shed. Usually one or more susceptible animals were placed among them to control the presence of any accidental infection. As soon as the first symptoms of disease made their appearance the affected animal was immediately transferred to the shed where the sick animals were kept.

The following table is drawn up to give a very brief summary of the experiments.

TABLE.

Experiment Number.	Material used for inoculation.	Result.
1	Water extract of liver, spleen and lymph glands, 3 days old, 100 c.c.	Death, 8 days.
2	do. do.	do. 7 do.
3	Phenol (0·5%) extract of liver and lymph glands, 5 days old, 200 c.c.	do. 8 do.
4	Phenol (0·5%) extract of liver, spleen and lymph glands, 5 days old, 200 c.c.	do. 8 do.
5	Phenol (0·5%) extract of heart, 5 days old, 200 c.c.	Bled to death for virulent blood 9 days afterwards showing marked symptoms.
6	Phenol (0·5%) extract of skeletal muscle, 5 days old, 200 c.c.	Showed no symptoms but later proved to be highly susceptible.
7	Phenol (0·5%) extract of liver, spleen and lymph glands, 15 days old, 200 c.c.	Death, 9 days.
8	Phenol (0·5%) extract of caecum and colon, 5 days old, 100 c.c.	Bled to death for virulent blood 9 days afterwards showing marked symptoms and lesions.
9	Phenol (0·5%) extract of larynx, pharynx and base of tongue, 5 days old, 100 c.c.	Showed no symptoms but later proved to be highly susceptible.
10	Phenol (0·5%) extract of liver, spleen and lymph glands, 8 days old, 50 c.c.	Death, 10 days.
11	Phenol (0·5%) extract of liver. spleen and lymph glands, 15 days old, 200 c.c., 3 animals inoculated.	One was bled to death for virulent blood 6 days afterwards showing marked symptoms; the other two, death 9 days after inoculation.
12	Phenol (0·5%) extract of liver, spleen, parotid and lymph glands, 16 days old, 200 c.c.	Death, 9 days.
13	Phenol (0·5%) extract of liver, spleen, parotid and lymph glands, 20 days old, 200 cc..	Death, 11 days.
14	Phenol (0·5%) extract of liver, spleen and lymph glands, 15 days old, 200 c.c.	Developed marked symptoms but on the 10th day commenced to recover and later proved to have become immune.

TABLE—*cont.*

Experiment Number.	Material used for inoculation.	Result.
15	Phenol (0·5%) extract of liver, spleen and lymph glands, 29 days old, 200 c.c.	Developed appreciable symptoms but 13 days later recovery was complete and the animal was shown to have become immune.
16	Phenol (0·5%) extract of pancreas, 5 days old, 100 c.c.	Showed no symptoms but later proved to be highly susceptible.
17	Phenol (0·5%) extract of liver, spleen, parotid and lymph glands, 55 days old, 120 c.c.	Death, 13 days.
18	Phenol (1%) extract of lymph glands, 6 days old, 100 c.c.	do. 10 do.
19	Phenol (1%) extract of liver, spleen, caecum and lymph glands, 17 days old, 100 c.c.; 1–1,000% chlorazene solution was also added 1 day before used.	do. 10 do.
20	Phenol (1%) extract of lymph glands 20 days old, 100c.c.	do. 8 do.
21	Phenol (1%) extract of liver 21 days old, 100 c.c.	do. 12 do.
22	Phenol (1%) extract of spleen 21 days old, 100 c.c.	do. 9 do.
23	Phenol (1%) extract of lymph glands 17 days old, 100 c.c.	do. 6 do.
24	Phenol (2%) extract of spleen 5 days old, 50 c.c. (agitated 48 hours).	Developed a mild attack, treated with anti-rinderpest serum, and later proved to be immune.
25	Phenol (2%) glycerine (25%) extract of spleen 5 days old, 50 c.c. (agitated 48 hours).	Showed no symptoms but later proved to be susceptible. Several similar experiments were tried using liver and lymph glands and it was found that the virus was destroyed in each case where glycerine was added.
26	Phenol (2%) extract of lymph glands 8 days old, 50 c.c. (agitated 48 hours).	Showed no symptoms but later proved to be susceptible. Negative results were similarly obtained by treating liver tissue in the same way and for the same length of time. Heart and intestine extracts were found to lose their virulence in 6 days when treated in this manner.

From the results obtained in the course of these experiments Boynton recommends the use of a 0·75 per cent. phenol extract of organs not over 15 days old in connection with inoculations against rinderpest by the simultaneous method in the field.

"From the results obtained in working with rinderpest it is very plausible that similar or even better results may be obtained with the virus of hog cholera along these lines.

"The tissues best adapted for this work are the liver, spleen, lymph glands, heart, fourth stomach, caecum, and colon."

BOYNTON (William Hutchins). **Note on the Use of Organ Extracts in Place of Virulent Blood in Immunization and Hyperimmunization against Rinderpest.**—*Philippine Agric. Rev.* 1917. Fourth Quarter. Vol. 10. No. 4. pp. 448–455.

"One of the problems in the production of antirinderpest serum is the reduction in the cost of producing virulent material to be used in hyperimmunization. Various methods have been used with more or less success. Nicolle and Adil-Bey (1901) were the first to develop a method by which the virulent material could be increased. When an infected animal presented symptoms of diarrhoea they introduced into the peritoneal cavity a mixture composed of 3 volumes of normal saline solution and 1 volume of a slightly alkaline solution of Martin peptone. They introduced 6 liters of this material into yearling cattle (the quantity varying according to the size of the animal) and after three hours the animal was bled to death, the peritoneal cavity opened and the fluid aspirated. After allowing this fluid to coagulate, the clear liquid was drained off and used. The fluid thus obtained gave an increase in virulent material which was used with success in hyperimmunisation.

"Reudiger (1908) obtained equal results using normal saline solution which he allowed to remain in the peritoneal cavity one to two hours before bleeding the animal to death and withdrawing it. The same author also used a 5 per cent. sodium-citrate solution with equal results.

"Holmes diluted the virulent blood with an equal volume of potassium-citrate solution and claims the diluted blood gave better results than undiluted defibrinated blood.

"Martoglio (1915) has developed the latest method in which he claims to increase the virulent material about 70 per cent. His technique is as follows:

"When the infected bovine presents the buccal lesions, usually at the end of the fourth or fifth day of the fever, less commonly at the end of the third, sixth, or seventh, it is immobilised in the stocks and intubed in the jugular and the carotid on the same side. The jugular is put in communication with a capacious glass receptacle placed on a level with the head of the animal and containing saline solution, sterilised and at a temperature of 38° to 39° C., leaving the outlet tube of rubber closed by compression of pincers. . . . The carotid is put in communication with the receptacle which receives the pest blood, and the bleeding begins.

"When the convulsions preceding the death-struggle begin, the bleeding should stop. The assistant shuts the tube for drawing the blood with a clamp and opens the tube admitting the sodium-chloride solution; immediately the serious symptom-complex changes, the muscular contractions begin to cease, the respiration and pulse that were accelerated become regular and the animal when it has received about as much solution as it has lost blood, enters a period of calm.

* * * * *

"We usually inject enough solution to make two and a half times the volume of blood taken, and without ill results. . . . The operation over the animal returns to its shed without assistance. After a lapse of about 5 or 6 hours the animal is bled from the same carotid, this time until it dies.

"By this method Martoglio claims to wash out the blood vessels and lymphatic system and obtain a potent virus.

"Dr. Stanton Youngberg, Chief Veterinarian, Bureau of Agriculture, and Dr. D. W. Shaffer, formerly in charge of the Phil. C. Whitaker anti-rinderpest serum laboratory, Manila, have been using a simple method of slightly increasing the production of virulent blood, as follows: The injected animal is bled from 2 to 4 liters of blood, depending upon its size, on the second day of temperature; the animal is then allowed to stand over night, during which time the body has an opportunity to replace the volume of the blood lost; on the following day it is bled to death. In the final bleeding practically as much blood in bulk is obtained as would be procured in a single bleeding, which gives an increase in virulent material corresponding to the amount obtained at the initial bleeding."

In the manufacture of the tissue extract the organs recommended for use [see preceding extract] are passed through a meat grinder with twice their bulk of 0·75 per cent. phenol solution, and the same technique as recommended in that paper is then followed. From one bull it was thus possible to obtain 11 litres of filtered extract in addition to 9 litres of virulent blood.

The author then discusses the results obtained by this method, and draws the following conclusions:—

"1. Considering the results thus far obtained it is quite evident that tissue extracts from animals suffering with rinderpest are just as potent as virulent blood when used in simultaneous immunization work.

"2. Any of the methods advocated for increasing the production of virulent material can be utilised, after which the organs can be extracted, thereby obtaining a much greater increase in quantity.

"3. By using Martoglio's method and extracting the organs the output of virulent material is practically tripled.

"4. If the extracts are kept at a temperature of approximately 15° Centigrade they can be used with safety in 2,000 cubic centimetre doses for hyperimmunization.

"5. Considering our results up to date the extracts should not be given in massive injections if they have been exposed for a period of eighteen hours to the climatic conditions found in the Tropics.

"6. These extracts can be produced so easily that this method can be used in any immunization station.

"7. Considering the similarity of hog cholera to rinderpest this method should be as applicable in that disease as it is in rinderpest, thereby reducing the enormous cost of the virus."

✓ YOUNGBERG (Stanton). **Observations on the Immunity to Rinderpest of the Nellore (Indian) Cattle and of the various Nellore-Native Grades.**—*Philippine Agric. Rev.* 1917. Fourth Quarter. Vol. 10. No. 4. pp. 436–447. With 6 charts.

During the year 1909 the Bureau of Agriculture of the Philippine Islands purchased a number of cattle from the district of Nellore, Madras Presidency, for the purpose of ascertaining whether these animals could readily adapt themselves to the climate, feeding, and needs of the country, and also to determine whether they could be used to improve the native breeds of cattle. It was found that the Nellore cattle readily adapted themselves to the conditions in the lower altitudes of the Philippine Islands and that when crossed with native and Chinese dams a very good type of animal was produced. A considerable number of Nellore cattle has thus been imported into the Islands since that date.

The high resistance to rinderpest of the "plains" cattle of India has long been recognised; the idea became prevalent among breeders in the Philippine Islands that this resistance could be transmitted to the offspring produced by crossing with native and Chinese dams. The author, however, produces a considerable amount of evidence gathered from statistics relating to naturally occurring outbreaks and experimental cases which controverts this idea and thus he draws up the following conclusions:—

"1. The pure Nellore cattle are very highly resistant to the Philippine strains of rinderpest, the mortality being insignificant. They are not, however, absolutely immune.

"2. In the case of native cattle, the infectivity of the virus is not appreciably attenuated by being passed through Nellore cattle. This fact makes the latter very dangerous as conveyers of the disease, as they may react without showing clinical evidence.

"3. The half-bred Nellore-native cattle do not inherit the high degree of resistance to rinderpest possessed by the Nellore stock. In infections of moderate virulence they apparently have somewhat more resistance than the native animals, but in virulent infections this resistance does not afford them any protection.

"4. From the inconclusive evidence at hand, the three-fourths Nellore-native grades appear to have a greater resistance than the native stock.

"5. The rinderpest problem of the Philippine Islands can not be solved by the importation of Nellore or other Indian cattle unless possibly by carrying it out to the extent of practically eliminating the native stock."

NOGUCHI (Hideyo). **Further Studies on the Properties of Pure Vaccine Virus cultivated** *in vivo.—Jl. Experim. Med.* 1918. Mar. 1. Vol. 27. No. 3. pp. 425–442.

In a paper published in 1915 Noguchi showed

"that a sample of vaccinia virus free from bacterial impurity and at the same time of sufficient strength for practical purposes, can be propagated in the testes of certain animals, particularly rabbits. There were still several points, however, which seemed to require further investigation. It was not known whether or not, through continuous cultivation *in vivo* in the testicular tissues of rabbits, the biological properties of the virus would finally undergo modifications. Since the natural habitat of the virus is the skin, it is not improbable that the new medium in which it has been induced to grow might have a deleterious influence upon it. It was necessary to determine the viability of such a virus under varying conditions, that is at different temperatures, with the addition of antiseptics, etc. It was desirable also to compare the resistance and viability of the testicular strain with those of the virus propagated in the dermal tissue. These are questions not merely of purely academic interest, but of practical importance, inasmuch as the proper utilization of the new vaccine depends to a great extent upon the right understanding of its properties."

The nature and results of the author's experiments are indicated in the following summary:—

"1. The virulence of vaccine virus for the testicular tissues increases until its maximum is finally reached. The selective increase is not associated with any loss, reduction, or modification in its virulence for the skin. A highly potent testicular vaccine is also highly active for the skin.

"2. The testicular strain of vaccine virus has no more tendency to localize in various organs than the ordinary skin strain. Both may localize in adjacent lymph nodes when introduced intravenously, subcutaneously, or intratesticularly in sufficiently large quantities, but other organs are not involved.

"3. Intravenous inoculation of an excessive amount of a powerful vaccine virus (1 to 2 c.c. of undiluted stock emulsion), irrespective of whether it is from the testis or the skin, will result in a generalized eruption over the entire body surface of rabbits. The eruption may be confluent on mucous membranes of the mouth, nostrils, genitalia, etc. Intratesticular or subcutaneous inoculations of the same virus fail to produce this effect.

"4. Subcutaneous or intravenous introduction of much smaller quantities of the virus does not cause an appreciable local or general reaction in the rabbit. But the animals which have once received these injections become refractory to a subsequent vaccination as applied to the skin. It seems probable that an active immunity has been conferred.

"5. Experiments on the viability and resistance of the testicular strain of vaccine virus indicate that the virus is best preserved when emulsified with Ringer's solution or 0·9 per cent. saline solution. Distilled water, while apparently one of the best diluents, fails to keep the virus active as long as Ringer's or saline solutions. As would be expected, the lower the temperature is, the longer the virus retains its viability. At 18° or 37° C., the deterioration of the virus proceeds rapidly. However, a small part of the virus survives after many weeks' standing at 37° C.

"6. Of the two most commonly employed chemical agents for the ripening (eliminating bacteria) process of the green vaccine pulp, glycerol and phenol, the latter is the less injurious. Phenol in concentration above 2 per cent. destroys the virus within 24 hours at any temperature, but it has almost no injurious effect when used in 0·5 to 1 per cent. On the other hand, glycerol is a powerful vaccinicide. When used in full strength it destroys the virus within 24 hours, even at 4° C. In a concentration of 40 per cent., that ordinarily recommended for the ripening, the virus retains some of its virulence for about half a year at 4° C., while at higher temperatures the same concentration kills the virus within 1 to 2 months. The virus preserved in distilled water or Ringer's solution under similar temperature conditions remains more active during this period. From this it may be concluded that glycerol is not an indifferent agent, as is assumed by many, but a powerful vaccinicide when used in high concentrations. The injurious effect is markedly accelerated at 18° or 37° C.

"7. The vaccine virus retains its virulence better in a sealed tube containing either hydrogen, nitrogen, or air than in an open receptacle. The virus deteriorates when placed in a sealed tube with oxygen or carbon dioxide.

"8. Desiccation decreases to a considerable degree the virulence of the vaccine virus. In the dried state the virus retains its viability about as long as does the emulsion, but it is not protected from the deterioration caused by age under various conditions.

"9. Iodine is a powerful disinfectant for the vaccine virus, but its sodium and potassium salts have no effect. Various bile salts destroy the vaccine virus when employed in sufficient concentration."

MISCELLANEOUS.

VELU (H.). **La Septicémie contagieuse du porc au Maroc.** [Contagious Septicaemia of the Pig in Morocco.]—*Bull. Soc. Path. Exot.* 1918. Feb. Vol. 11. No. 2. pp. 117–124.

Throughout the year 1917 very serious and markedly contagious outbreaks occurred in several herds of pigs in the Chaouia region of Morocco. The first outbreaks of enteritis, which took place in the spring, occurred among sucking pigs and were considered to have been set up by cold. Later, during the summer, the principal lesions affecting the young pigs were oedematous swellings around the neck and head, and these lesions were attributed to anthrax on account of the existence of that disease among bovines. Still later, in the autumn, older pigs from 5 to 10 months old became affected with pleuropneumonia.

Briefly, the author sums up from clinical observation that there exists a markedly contagious disease of pigs in Morocco affecting preferably young or middle-aged subjects, characterised mainly by the lesions of a septicaemia, pulmonary hepatisation, swelling and haemorrhagic infiltration of the lymphatic glands, congestion and petechiae of the skin and mucous membranes, congestion and catarrhal inflammation of the intestinal mucous membrane, but with no croupous or diphtheritic lesions.

A bacteriological study almost invariably revealed the presence in the bronchial glands, pulmonary lesions and exudates of an ovoid bacterium considered to be a Pasteurella. An experimental study showed that this ovoid bacterium was pathogenic for the pig, and that a disease similar in appearance to the natural disease could be reproduced by inoculation of cultures. The pigs became contaminated through the medium of infected faeces and the channels of infection were the upper respiratory and digestive tracts. No filtration experiments were performed and these were considered unnecessary by the author inasmuch as he succeeded in reproducing the disease in a susceptible pig by inoculating a culture of the organism after it had been transmitted in series through two rabbits and artificial culture media.

[The probability that the natural disease was caused by a filterable virus is by no means excluded by such experiments as the author describes.—Ed.]

Woods (H. S.). **Mysterious Outbreak of Disease among Cattle.**—*Rhodesia Agric. Jl.* 1918. Feb. Vol. 15. No. 1. pp. 29–31.

In this article the author records an outbreak among cattle in North Western Rhodesia in the autumn of 1917, probably set up by poisoning. The mortality varied from 2 to 22 per cent. on different farms. The affected animals showed acute nervous symptoms which varied in intensity; in the more acute cases the animals were either dead in a few minutes or had numerous fits, in any one of which death might occur; the less acute cases might last up to 24 hours, when the animals usually recovered. Microscopic examination of smears from the blood and other organs gave negative results.

Togoland. **Report upon a Disease among Goats in the Lome and Lomeland Districts of Togoland.**—MS. Reports received from Colonial Office, dated 27th Dec. 1916 and 30th Nov. 1917. [By Oakley (Philip D.) & Popham (H. B.).] With 2 photographs. 13 pp. f'cap.

This correspondence contains information supplied by the Political Officer of the above districts (Popham H. B.) and the Medical Officer, Lome (Oakley P. D.) regarding an outbreak of disease among goats n the country around Tsewie. The disease was first reported in this locality in November 1916. The morbid changes produced are said to resemble very closely those observed in nodular leprosy, hence the native name Myi meaning leprosy. Animals of all ages and both sexes are affected to a similar degree. The disease is not known to affect sheep or cattle. It is almost invariably fatal within from 4 to 5 months after its onset.

The affection is first manifested by the appearance of small sores all over the body. These sores grow rapidly in size and tend to discharge a white sticky matter which dries up forming hard irregular masses. The hair begins to fall off particularly on the hind quarters. After a short period the animal begins to move about slowly and shows inappetence; the buccal mucous membrane becomes ulcerated marked salivation being thereby produced; a white frothy substance is also discharged from the nose and a thick white fluid from the eyes. Swellings are produced around the eyes and nostrils. The legs become covered with hard white crusts, and the animals are also stated by natives to become affected with marked diarrhoea. Forty affected animals were examined by OAKLEY himself but no diarrhoea was observed in the cases which came under his observation. Post-mortem examination of one goat found dead of the disease showed no lesions in the internal organs. Microscopic examination of blood films gave negative results. Smears were also taken from the nodules and stained, without furnishing any indication as to the cause of the disease. No scrapings appear to have been examined as to the presence of mange parasites. Measures were taken to prevent the further spread of the disease by destruction and burning of affected goats and segregation of in-contacts.

From the description of the disease, the Acting Pathologist, Accra, (INGRAM A.) suggests that it might be a blastomycosis. The real nature of the disease, however, can only be determined by submitting an infected animal or the diseased parts to a pathologist for examination.

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[Continued from this *Bulletin*, Vol. 6, No. 1, pp. 61–65.]

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TROPICAL DISEASES BUREAU.

TROPICAL VETERINARY BULLETIN.

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DISEASES DUE TO PROTOZOAN PARASITES.

SMITH (THEOBALD) & GRAYBILL (H. W.). **Coccidiosis in Young Calves.** —*Jl. Experim. Med.* 1918. July 1. Vol. 28. No. 1. pp. 89–108. With 3 plates comprising 7 figs.

Coccidiosis in cattle has been found to be a by no means uncommon condition in many parts of the world, especially in tropical and sub-tropical countries, since it was first studied in 1892 by ZSCHOKKE and HESS in Switzerland, where it was known as *rothe Ruhr*. Until quite recently, however, the disease does not appear to have been observed in the United States of America. SCHULTZ (1915) undoubtedly recognised its existence among cattle in the north western states. In the prosecution of certain researches upon the diseases of calves in New Jersey Smith and Graybill encountered coccidiosis unexpectedly in association with other diseases. Beyond a microscopic examination of the faeces no detailed study of cases appears to have been made by any observers except ZÜBLIN (1906) in Switzerland, and thus the above two authors undertook a somewhat exhaustive study with the small amount of material available in the course of a small epizootic. Their observations therefore merit notice at some length.

The first case containing coccidia was examined post-mortem in April 1917. Other cases followed during the spring and summer. A few coccidia were found in a calf as late as December. The severest, fatal cases occurred in summer. The infection is stated probably to begin soon after birth, and continue over a period of 6 to 8 weeks at the longest, unless death occurs in the meantime from it or some concurrent affection. The characteristic blood in the faeces first occurred in from 3 to 6 weeks after birth and probably when the first group of oocysts was being discharged. In several severe cases, however, blood did not appear in the faeces. There was no evidence of active multiplication of coccidia in cattle older than three months. The disease appeared to exert itself chiefly upon the very young, the older animals having acquired a certain degree of resistance. The infectiousness of the disease did not appear to be very great. Calves were kept together in lots of six or over in small indoor enclosures and were allowed to run together in small yards. Assuming that the oocysts passed in the faeces become infectious within a few days in warm weather there was a striking difference in susceptibility of different calves of the same lot. The presence of pneumonia or interstitial nephritis did not seem to exert any influence upon the susceptibility of the animals.

In Züblin's report the disease was not mentioned to affect young calves. His cases occurred principally in animals at pasture and in one herd of ten cattle, all of which were infected, the ages ranged from six months to two years. According to this observer the first sign of the disease is the passage of blood clots, about 10–15 c.c., in normal faeces by clinically normal animals. One or two days later the blood is more abundant and defaecation more frequent. A case may now return to normal or may grow worse. Usually the older animals recover promptly. In younger animals the quantities of blood passed may increase up to a man's fist in size. The tenesmus becomes more intense and the faeces tend to become thin and foul smelling; the temperature rises, the respirations increase in number, and the appetite is abnormal. From the 5th to the 8th day the admixture of blood in the faeces is replaced by mucus and masses suggesting croupous inflammation of the large intestine. The faeces are watery and putrid. All other symptoms are accentuated and fever is present. With the loss of blood and refusal of food the animal becomes very weak and death occurs often as early as the 7th day. The mortality in Züblin's cases was 5 per cent. The symptoms in his cases point to septic infection as the probable cause of death. It is obvious that the mortality rate in this disease will depend on the presence of septic organisms in the lesions and their relative degree of virulence, for the coccidia themselves do not cause inflammatory reactions but simply open the way for bacterial infection.

Diagnosis was made by Smith and Graybill by direct examination of blood or mucus when present in the faeces. In cases where the faeces were free from blood and the coccidia could not be detected directly the following method, which is a simplified modification of Hall's method, was adopted by the authors.

> "A mass of feces is thoroughly shaken in a closed Mason jar partly filled with water, until well broken up. Then the jar is completely filled with water and the feces are permitted to settle. The water is poured off and the jar again filled with water. The sedimentation, decantation, and washing are continued until the water is nearly clear. In this way the particles lighter than water are removed. The sedimented feces are next mixed in a jar with about enough water to fill a cylinder in which they are to be sedimented and are poured through a tea-strainer held over the cylinder. By stirring the portion of the feces held back in the strainer and by dipping the bottom of the strainer up and down in the water after it nearly reaches the top of the cylinder, oocysts that have been held back are permitted to pass through. After the feces have settled to the bottom, a sample is taken with a pipette of wide caliber, mounted, and examined. By this method a few oocysts were brought to light in normal stools from calves apparently in good health."

No characteristic macroscopic lesions were present in the large intestine. In the more severe cases "congestions and small punctiform haemorrhages were the most definite alterations noticed. The diagnosis will in all cases depend on the microscopic examination of the feces, or on sections of the large intestine, or on both combined."

The parasite. After examination of the oocysts in the faeces it became evident that there were two species of coccidia infesting the calves

The species first encountered and present in large numbers was distinguished by a small oocyst usually elliptical but occasionally ovoid in outline. The wall was double-contoured, uniform in thickness, and as a rule thinner than the wall of the oocyst of the other species. Oocysts were encountered in which the protoplasm completely filled the cyst wall. All stages to that in which the protoplasm was contracted to a circular mass removed from the cyst wall or touching it only at one side were observed. When the protoplasmic mass was well contracted it was located as a rule near the centre of the cyst but sometimes it came in contact with some part of the wall. The cytoplasm contained highly refractile granules of varying size and distributed uniformly or irregularly throughout it. The nucleus was sometimes visible. The length of the oocyst varied from 13·1 to 28·7μ (average 18·6μ), and the width from 12·3 to 20·5μ (average 14·8μ). The evolution of the oocysts was studied by observing their development on the surface of agar plates moistened from time to time with a little distilled water and kept in a moist chamber, at room temperature. The medium consisted of 2 per cent. agar and 0·5 per cent. sodium chloride in distilled water. In this small species with ellipsoidal oocysts four spherical sporoblasts formed; these became elliptical in outline and developed into spores. These spores were elongated, elliptical, circular on cross section and tapered a little at one end. Each spore was surrounded by a thin single contoured membrane which was thickened into a minute cap at the small pole. There was no residual body (*Restkörper*) left behind in the formation of the sporoblasts and there was no residual body in the spore.

Two sporozoites formed in each spore and these were round at the broad end and tapered towards the other end. In one instance the tapering end was seen to be pointed. In the middle of the sporozoites or possibly more frequently in the large end was generally found a rather large, more or less well-defined mass of very minute granules. Elsewhere the protoplasm was homogeneous in appearance. The nucleus was located nearer the broad end and consisted of a small granule surrounded by a halo. The lines separating the sporozoites ran diagonally across the spore. The sporozoites completely filled the spore. The spores did not vary much in size; the few specimens measured varied from 9·9 to 11μ in length, and 5·3 to 5·7μ in width.

The second species, characterised by large distinctly ovoid oocysts, was first encountered in a calf dying in June and subsequently in most cases either in the faeces or in fresh scrapings of the mucous membrane or in sections. The wall of the oocyst was sometimes brownish in colour, sometimes colourless, and was thickest at the broad pole and very gradually diminished in thickness towards the small pole. The difference at the two poles was not great, yet distinctly noticeable. Some cysts occurred, however, in which the wall was uniform in thickness. There was no evidence of a micropyle. The cytoplasm as a rule was contracted into a circular mass located at the middle or in the broader portion of the cyst, occupied two-thirds to three-quarters of the space within the wall, and came almost in contact with the sides; it was filled with large highly refractile granules. The nucleus was not visible. The length ranged from 25·8 to 41·8μ (average 29·9μ) and the width from 16·4 to 24·6μ (average

19·9). In this species the mother sporoblast or oocyst produced four spores without leaving behind a residual body. The spores were similar in appearance to those described in the case of the preceding species with the exception that within each spore was found a large residual body. This body was elliptical or fusiform in shape and lay generally against the wall of the spore, but sometimes in a space formed between the sporozoites, in which case it occupied a diagonal position with respect to the spore; it contained rather large round highly refractile granules of approximately equal size.

The small ellipsoidal form was the numerically predominating type and in a few cases the one exclusively seen. The existence of two distinct species, as alleged by the authors, might be disputed on the ground that considerable variations in size and form are to be found in other single species of coccidia. However, pending further investigation they point out that forms intermediate in both shape and size between the two types of oocysts were not encountered. Also, the presence of a residual body in the large and its absence in the small oocyst is noteworthy. On the other hand, inasmuch as both types from a case might be seen in one field of the microscope the burden of proof rests with the authors.

Studies to determine the exact time required at certain favourable temperatures for the oocyst to undergo maturation were not made. Approximate estimates based on observation of cultures indicated that in midsummer this portion of the cycle in the case of the ovoid type covered about 5 days. Similar estimates indicated a somewhat longer period for the ellipsoidal type. The authors then give a brief outline of the development of the parasite in the mucous membrane of the host. A detailed account is promised later. However, according to their observations nothing was seen suggesting "that the coccidia encountered departed in any significant way from the cycle as mapped out for such a well known coccidium as that of the rabbit."

Careful study of the sections did not enable the authors to distinguish between the above two alleged species in the schizogonic cycle. This may have been due to the relative scarcity of the larger parasite in the material at hand.

As regards the pathology of the disease in the calves the authors state that the seat affected was the large intestine. In the small intestine scattered tubules were found invaded by one or two parasites, rarely by many, even when the large intestine was severely involved. The forms encountered were more often gametes than schizonts. In some tubules sexual and asexual stages were intermingled.

In the large intestine the infection appeared at first in circumscribed foci which tended to grow larger and in some cases coalesce with one another. Usually a certain stage, such as schizogony, prevailed in any one focus. Later both sexual and asexual forms were found together. In the same tubule one might then find fully developed merozoites, macrogametes, microgametocytes, and oocysts. The fertilised oocysts were probably discharged very quickly for they were not abundant in the tubules. Oocysts might be discharged in large numbers in the faeces while schizogony was going on. Not infrequently there were found scattered empty shells of oocysts in the connective tissue between tubules infected with the schizogonic forms; these remains of oocysts probably represented aberrant forms which had failed to become discharged into the lumen of the intestine in the course of an earlier infection.

The relative immunity of the small intestine as compared with the large intestine is noteworthy. In rabbits and birds (sparrows, hens, turkeys, and pheasants) the principal seat of invasion is the small intestine and the large intestine and caeca only become secondarily involved. Other facts of interest are the self-limitation of the disease in a number of cases and the apparent complete immunity of some calves penned with severe cases.

With regard to the lot of calves observed by the authors brief details are given with regard to 8 cases affected with coccidiosis and terminating fatally; six calves passed blood clots containing large masses of oocysts and subsequently recovered completely; seven other calves in the same lot remained unaffected and samples of faeces concentrated before examination by washing and sedimentation did not reveal any coccidia.

In these cases of coccidiosis the ill effects upon the host may be attributed to, first, the local lesions and, secondly, to systemic disturbances caused by the entrance into the circulation of infective agents through the injured intestinal epithelium. With regard to the local lesions the changes set up by the early invasion of the epithelial cells are insignificant. The host cells retain their normal appearance except in point of size and inflammatory reactions are absent. When the parasites have become widely diffuse and occupy most of the cells a number of changes are evident. Under a low power the tubules are no longer normal in form and some appear to be missing; under a high power the disappearance of the tubules is seen to be due to the loss of the lining epithelium surrounding each tubule and the invasion of the lumen with cellular elements, mostly polynuclear leucocytes. The surface epithelium is also attacked and small masses of leucocytes, fibrin, and red blood corpuscles cling to the denuded surface in places and indicate the source of the haemorrhages. These masses have embedded in them many oocysts. The masses of blood in the faeces are thus produced by the conglomeration of many small haemorrhages from the capillaries near the surface of the intestine, and this explains why the source of the blood is not macroscopically evident on post-mortem examination.

A further lesion found in advanced stages is a complete necrosis of a limited patch of mucous membrane involving up to ten or more tubules. In this focus the cell nuclei have either completely disappeared or are broken up into fragments or pyknotic; the cytoplasm takes a distinctly reddish tint with eosin.

Owing to the frequent occurrence of pneumonia associated with the coccidiosis in the cases studied the injuries other than local could not be definitely ascertained. A specific kind of organism considered to be a probable etiological factor was discovered in most of the cases of pneumonia.

Up to the end of May 1918 only one case of bloody dysentery was subsequently observed in the above herd. This occurred in a calf over 11 months old; the coccidia found in the faeces were of the smaller, elliptical type; the symptoms readily disappeared.

HAUGHWOUT (Frank G.). **Infections with Coccidium and Isospora in Animals in the Philippine Islands and their Possible Clinical Significance.**—*Philippine Jl. Sci.* 1918. Mar. Vol. 13. Sec. B. No. 2. pp. 79–93. With 5 text-figs.

In this paper the author enters into a general discussion with regard to the organisms usually spoken of as coccidia. He reminds the reader that all these organisms do not necessarily belong to the genus *Coccidium*, this genus constituting only one of a large number of genera grouped together within the order Coccidiidea. This order is divided up by LEGER into four families—Asporocystidae, Disporocystidae, Tetrasporocystidae, and Polysporocystidae.

The two genera considered particularly in this paper are the genus *Isospora* (family Disporocystidae, in which the oocyst contains two sporocysts), and the genus *Coccidium* (family Tetrasporocystidae, in which the oocyst contains four sporocysts).

Recently the Department of Medical Zoology received material that apparently represented six different kinds of coccidial infection, viz., (1) an organism found in the kidney of a guinea-pig, probably identical with SEIDELIN'S *Klossiella cobayae*, a member of the family Polysporocystidae; (2) a coccidial infection of undetermined nature in the testis of the house lizard; (3 & 4) a Coccidium and a species of Isospora in the intestinal tract of the house lizard; (5) *Isospora bigemina* in the intestine of kittens; (6) *Coccidium cuniculi* in the rabbit, believed by many to be identical with the coccidian parasite that has been reported in man.

The author deals with the question of the specificity of the various species of coccidia found in animals and particularly with regard to the possibility of their being infectious for man. Up to the present it appears that 34 well-authenticated cases of human coccidiosis have been recorded, but the specificity of the parasite found in these cases has not been established.

A few preliminary notes are given with regard to the above coccidia. The Coccidium from the intestine of the lizard was usually oval in shape, sometimes spherical; the oval oocysts measured 20μ by 16μ, while the spherical ones measured from 19μ to 20μ in diameter, which brings them rather close in point of size to the measurements recorded by WENYON for his human Coccidium. The oocysts of *C. cuniculi* ranged from a length of 33μ to 49μ by 15μ to 28μ in breadth.

Measurements of a few oocysts of the author's cat Isospora showed a variation in length of from 29μ to 38μ and in breadth of from 22μ to 29μ, all the cysts being oval. It is stated that these figures do not wholly coincide with the measurements of oocysts, of presumably the same species, made by other workers. STILES (1892) reports measurements of from 24μ to 40μ in length and from 19μ to 28μ in breadth, while SWELLENGREBEL gives a length of from 39μ to 47μ and a breadth of from 26μ to 37μ.

CLARK (Herbert C.). **Piroplasmosis of Cattle in Panama.**—*Jl. Infect. Dis.* 1918. Feb. Vol. 22. No. 2. pp. 159–168.

Towards the middle of the construction period of the Panama Canal the Hospital at Ancon organised a dairy and stocked it with animals from the United States, chiefly from the Gulf coast region. A number of pigs and a considerable number of chickens were also imported and subsequently the enterprise grew to such proportions that it required more space and was removed to a neighbouring village where it is now known as the Corozal farm. A few cases of tuberculosis were found in the imported cattle, a condition which is never found in the native cattle. In addition, contagious abortion and other conditions common elsewhere were at times encountered among these animals. Hog cholera also made its appearance.

It was noted that the calf mortality was higher than is usually to be expected in well cared for stock. Clinical and post-mortem examination failed to explain the number of deaths among the calves and although piroplasmosis was suspected the presence of the disease could not be demonstrated. The development of the Hospital Dairy encouraged local cattle owners to take up dairy farming on a more intensive scale and they thus imported Holstein and Jersey cattle for cross breeding with native stock. These imported animals soon became sick and many of them died. Piroplasmosis was again suspected but no piroplasms could be demonstrated by careful examination of blood films. The acute outbreaks of this disease were studied by DARLING in January 1915 and in his report he stated that the clinical picture of the disease in the imported animals was that of "Southern cattle fever," but examination of blood films from one animal after death revealed only some anaplasma-like bodies. At the close of the construction period of the Canal large pastures were cleared along its course for the purpose of receiving imported cattle and pigs in order to furnish a meat supply.

In November 1916 two calves, six and ten months old respectively, from the Hospital Farm were received in a moribund condition and examined post-mortem. The hides of both animals were tick infested and both were affected with intense anaemia and emaciation, but showed no sign of jaundice or haemoglobinuria. In the case of one animal there was no marked change in the spleen, there was parenchymatous degeneration in the liver, kidneys, and heart muscle, but no petechiae on any of the serous membranes. Films stained by Hastings' modification of the Romanowsky method from various organs and the blood showed a sparing number of *Babesia bigemina,* chiefly in the bone marrow of the rib, and the crushed grey matter of the brain cortex.

In the case of the other calf the spleen was on the other hand enlarged, and its capsule was tense and pulp soft, oozing, and purple. All the serous membranes contained areas of ecchymoses and there was extremely acute parenchymatous degeneration. Films from the various organs in this case all revealed *B. bigemina* but those made from the grey matter of the brain cortex and the ganglionic matter at the base of the brain showed the organisms in greatest abundance. These preparations showed capillaries that appeared to be stuffed with paired pyriform bodies. Some of these films were sent to Theobald SMITH, who confirmed the belief that the parasites were *B. bigemina.*

Subsequently, four weak emaciated tick-infested calves were obtained from another pasture of the Supply Department and kept under observation for from a few days to three weeks. They had fever but did not show the typical curve of the acute disease. Blood films were examined each morning and evening and in one case a few parasites were revealed in the peripheral blood as well as in preparations made from a female tick engorged with blood. No jaundice or "redwater" was noted in these calves while under observation but the haemoglobin content of the blood showed on an average a reduction of 50 per cent. Piroplasmosis was ultimately diagnosed post-mortem. All very sick animals in this particular pasture were now located and kept out of the herd. Tick eradication, along the lines employed in the Gulf coast region of the United States, was then instituted. The ticks were reported to be of the species *Margaropus annulatus australis*. Twenty-five more animals were in the meantime taken away from the herd; all were calves from six to ten months of age except two old native cows. Films from the brain, spleen, marrow and blood of the above 29 cattle thus obtained from this pasture gave the following results as regards the presence of *B. bigemina*.

	Positive.	Negative.
Brain films	29	0
Marrow film, rib	10	19
Spleen films	8	21
Blood films	3	26

The calves so far examined were born on the Isthmus and most of them were calves of native cows served by an imported bull. They had been exposed to tick infestation since birth. The constant presence of the parasite in these animals indicated that a latent type of the disease may be common among the cattle outside the Canal zone and in order to elucidate further this point the author undertook to examine brain films from an unselected series of prime beef animals immediately after they had been killed at the abattoir. The method of examination and results obtained were as follows:—

"Three or four blows with an axe, hatchet or machete just behind the horns will expose the brain, and as a rule the dura and the brain are not badly lacerated. A piece of the gray matter of the brain cortex about the size of a split pea was selected, placed on a glass microscope slide near its middle, another slide being used to crush it so that a film extends over half the slide. By increasing the pressure as one drags the material toward the ends of the slide it is possible to leave a film that is thick at the middle of the slide and thin at the end. At some place in the preparation networks of blood-filled capillaries will be found. The film is quickly dried and then stained as soon as possible in some polychrome blood stain. When ready for examination use low magnification to find some well defined thin areas containing capillaries, and then a high magnification. The capillaries can then be traced for blood cells containing parasites. Many times the first field of capillaries examined in the slaughter-house revealed one or more parasites. The average time spent in searching in a particular case was 3 minutes, although some of the cases required 20-30 minutes.

"The beef cattle of Panama came from all parts of the cattle region of the Republic. They were examined in lots of 20–25 just in the order that the authorities chose to kill them without regard to age or degree of tick infestation. Every animal of the 125 examined showed *Babesia bigemina* and in spite of a rather fair degree of infection in some offered no clinical sign of the disease.

"The supply department imports a similar class of animals from Colombia which are slaughtered at Cristobal. An examination of 150 of these showed that 90 per cent. were carriers of the same parasite.

"Other opportunities have been taken to examine cattle of all types in outlying regions as well as in the basin of the Chagres river as far up the river as inhabitants are to be found. In all localities the disease was present. Native cattle suffering serious injury, long periods of starvation, etc., develop piroplasmosis, at least their examination showed an abundance of parasites.

"It appears from these results that almost all the cattle of Panama and Colombia must be considered as carriers of the parasites of piroplasmosis. Since no protective measures are employed against the disease and since the tick in this locality continues an almost uninterrupted cycle of development throughout the year, all cattle born here are exposed to the infection from the time of their birth on. It is well known that calves survive the disease better than the fullgrown cattle that have not had the disease in their early life, nevertheless, it is possible that this disease partially explains the high death rate in calves in this country. The animals that do survive the calf period certainly acquire an immunity that protects them from future attacks provided injury, starvation, or some intercurrent disease does not undermine the vitality. The importation of non-immune cattle, when not followed by protective measures, is surely followed by considerable loss. Generally speaking, the native cattle (although hardy animals) do not fill out into the fat sleek animals commonly found outside a tick belt."

The author then discusses the pecularities of piroplasmosis in Panama cattle. Acute cases as a rule occur in non-immune imported cattle; many adult animals of this class are lost but a fair percentage of the calves survive. The clinical picture of the acute disease is like that described by SMITH and KILBORNE. Native animals suffer acute attacks when they are subjected to starvation, injury or an association of diseases. In the chronic form the animal appears wasted, anaemic and dull-looking with a tick-infested hide. Jaundice and haemoglobinuria are not often noted and the temperature curve is not characteristic. Carriers of the parasite may not show a single sign of the disease but usually they do not become large fat animals.

From the original report of SMITH and KILBORNE it appears that these authors only examined the brain in four of their cases and in these they found great numbers of the parasites in the pia mater, choroid plexus, and the brain substance. Since these were probably acute cases this organ did not impress them as a suitable one for routine examination. In both the acute and chronic forms of the disease there is a marked reduction in the haemoglobin. In other parts of the world from one to ten per cent. of the corpuscles in the peripheral blood are said to be invaded. The strange feature concerning the disease in Panama is that in no more than eight or ten cases was the author able to find the parasite in the peripheral blood even in acute cases, and he adds that the delayed identification of the disease in this region may be attributed to the extreme scarcity of the parasite in the peripheral blood and to the fact that brain examination was neglected. In acute cases in imported stock the author was able to confirm SMITH and KILBORNE'S observations with regard to the large percentage of corpuscles infected in the capillaries of the internal organs especially of the kidneys, but, nevertheless, the brain always revealed them in greater abundance and "when chronic cases and carriers are to be examined at necropsy or in the abattoirs the system of brain capillaries takes precedence over all others."

"It is reasonable to suppose that organs with intricate capillary systems favour the presence of such parasites, but the capillaries in the kidney, heart muscle, liver, spleen, etc. do not lend themselves readily to the preparation of films free of debris and which offer a sufficient number of intact corpuscles."

The description of the parasites found in the brain closely corresponds with that given in the classical accounts. A greater variation in the size and morphology of the parasite was found in the films from the rib. Single pyriform types and comparatively large irregular round forms were infrequently seen. The types seen in the peripheral blood of a few acute cases consisted of single pyriform bodies larger than one of the paired forms found in the brain, "So few 'anaplasma-like' bodies were found in the blood films and their position was so inconstant that it is unsafe to say that the bodies really represent parasites." The average size of the typical pyriform bodies found in an acute case in the brain measured 3·6 by 1·8μ.

The following animals were inoculated with the defibrinated blood from beef cattle known to be carriers of *B. bigemina*: 4 guinea-pigs, 1 donkey, 2 pigeons, 1 monkey, 3 opossums, 2 young dogs, 1 mule, 1 goat, and 2 non-immune calves. The calves developed the disease but no results were obtained in any of the other animals.

Moreover, additional investigations showed that native cattle in Panama acted as hosts in almost every case not only of *B. bigemina*, but also of filaria, sarcosporidia, and a large trypanosome probably of a harmless type. Two cattle harboured a spirochaete probably *S. theileri*. In Panama piroplasmosis has thus hitherto been found in the horse, cattle, deer, and dog.

GRIFFITHS (J. A.). **A Note on Piroplasmosis of the Donkey.**—*Jl. Comp. Path. & Therap.* 1918. June. Vol. 31. Pt. 2. pp. 131–133.

The author's observations were made in the North Nyasa district of Nyasaland and in the New Langenburg and Iringa districts of German East Africa. Piroplasmosis in the donkey has already been recorded by SCHELLHASE in German East Africa [see this *Bulletin*, 1914, Vol. 2, No. 2, p. 64] and by other observers in various parts of Africa. The disease appeared to affect more severely the white Zanzibar donkey and crosses of this breed with the native grey donkey; the latter breed appears to have a high degree of natural immunity. In its most common form the disease runs a chronic course and the number of parasites in the blood is small and varies daily. Usually not more than one per cent. of the corpuscles are invaded in a fairly heavy infection; exceptionally four per cent are attacked. In the chronic cases the parasites are often difficult to find.

The parasites vary considerably in shape—amoeboid, round, ring and match shaped forms have been noted at different periods during the course of an attack, in the order mentioned. Pear-shaped parasites were rare, occasionally parasites were seen in pairs, these being either leaf-shaped or match-like forms, and in several cases, where the parasites were joined at the extremities away from the nucleus a small granule of chromatin was seen at the junction. The nucleus, which is usually found towards the periphery in the amoeboid, round, and ring forms, is in these cases much smaller than in the pear-shaped and match-like forms where it consists of a darkly-stained, irregularly rounded mass at one end of the parasite. No cross forms were observed. Free parasites were seen in the plasma during the course of acute infections. The smaller round forms of the parasites resembled cocci in appearance and were almost invariably placed towards the periphery of the corpuscle.

Clinically the affected animals show, in the chronic form of the disease, the symptoms of anaemia; the animal becomes dull and listless, the mucous membranes are pale and there is gradual emaciation with progressive weakness. There is no febrile reaction. A rise of temperature would indicate some secondary infection. During an acute attack the temperature may rise to 104–105° F. and a common complication in these cases is broncho-pneumonia. Where the disease is secondary to a cylicostome infection a fairly high mortality (25 per cent. in two years) may be observed.

The period of convalescence is always very prolonged in emaciated cases. Many animals recover but always remain in poor condition. Trypanblue did not appear to exercise any beneficial effect in treatment. Careful attention to dieting is recommended in order to assist the animal's natural powers of resistance; iron preparations and nux vomica are useful in chronic cases, as adjuncts to a liberal diet.

LAVERAN (A.). **Infections du loir par *Leishmania tropica* et par l'agent de la leishmaniose naturelle du chien.** [Infections of the Dormouse with *L. tropica* and with the Causal Organism of Natural Canine Leishmaniasis.]—*Bull. Soc. Path. Exot.* 1918. June. Vol. 11. No. 6. pp. 445–448.

From his experiments on a number of dormice Laveran concludes that these animals are much more resistent than white mice to the virus of natural canine leishmaniasis. As in the case of white mice it was also to be noticed that the infections due to canine leishmaniasis and those due to *L. tropica* exhibited quite different characters. Canine leishmaniasis set up fatal visceral changes whereas *L. tropica* produced local lesions (in the testicular region) followed by recovery. Testicular lesions were noted in the case of the dormice inoculated with the canine virus but compared with the changes in the liver, spleen, and bone marrow they were very slight.

VELU (H.). **La trypanosomiase des chevaux du Maroc. Essais du traitement.** [Equine Trypanosomiasis in Morocco. Experiments on Treatment.]—*Bull. Soc. Path. Exot.* 1918. June. Vol. 11. No. 6. pp. 448–451.

During the course of a serious outbreak of trypanosomiasis occurring in 1916 among the horses of a native cavalry unit (125 affected out of a total of 178) Velu was afforded an opportunity of testing the action of several chemical products that appeared to have given encouraging results in the treatment of similar affections. The affected animals were kept under observation from July 1916 to July 1917. Eighty-six died and the remaining 39, presumably cured, were for military reasons allotted to various units and hence their subsequent history could not be traced. During the first quarter of the year 1917 these latter horses owing to special care and attention were kept in condition at a Remount Depot, but it was found quite impossible to put them to work requiring severe exertion; in June 1917 in spite of their apparent good health they were absolutely incapable of keeping up with other horses on the march.

In these experiments the affected animals were divided into lots as similar in condition as possible and control animals were also selected in the same conditions. Moreover, in the case of some drugs the author administrated for purposes of comparison massive doses to one series and numerous fractional doses, collectively exceeding a single massive dose, to another series. The products utilised were generally not employed alone but associated with other drugs and had to be administered intravenously on account of the irritation set up by subcutaneous or intramuscular injection.

The operation of intravenous injection requires great care owing to the fact that the vein may become traversed especially in the case of restive animals and thus a few drops of a solution of novarsenobenzol, for example, set up a very marked painful swelling in the perivascular connective tissue. Instead of using needles the author employed a small exploratory trocar, the canula of which could be adapted to fit an ordinary injection syringe. The length of the canula was 5 cm., external diameter $1\frac{3}{4}$ mm., internal diameter $1\frac{1}{2}$mm. After having inserted the whole length of the trocar and canula into the jugular, perforation of the opposite wall of the vessel then becomes impossible when the trocar is withdrawn from the canula. Within $2\frac{1}{2}$ months more than 1,000 intravenous injections were made in this way with only a single accident. The results of the treatment are indicated in the following table :—

Series.	Products employed.	No. of horses treated	Poisoned.	Natural death.	Total mortality.	Horses surviving over a year.
1	Atoxyl-Orpiment, massive doses	10	7	1	8	2
2	Atoxyl-Thiarsol Clin. ..	5	3	0	3	2
3	Atoxyl-Tartar emetic, massive doses	10	2	6	8	2
4	Tartar emetic, massive dose, Arsenicals, small dose ..	6	1	4	5	1
4B	Ibid.	5	0	2	2	3
5	Tartar emetic-Thiarsol Clin., massive doses	5	3	1	4	1
6	Tartar emetic-Galyl, small doses	5	0	4	4	1
7	Tartar emetic-Orpiment ..	5	5	0	5	0
8	Tartar emetic-novarsenobenzol	5	0	3	3	2
9	Tartar emetic, small doses. Arsenicals, small doses ..	5	0	3	3	2
9B	Ibid.	6	0	1	1	5
10	Novarsenobenzol, massive doses	5	0	2	2	3
11	Galyl, massive doses ..	5	0	3	3	2
12	Antimony trioxide	4	0	2	2	2
13	Controls, 1st class	6	0	4	4	2
14	Controls, 2nd class	6	0	0	0	6

If one leaves out of account series 7, where all the horses were poisoned by the administration of commercial orpiment, and series 9b and 14 composed of horses in which the disease was not recognised until the months of October or November it will be seen that the results obtained are strictly comparable in all the series including the control series 13. The various methods of treatment employed did not seem to have any action upon the course of the disease. Animals in a very advanced stage of the disease and those in an emaciated condition were much more sensitive to toxic doses than those in which the body condition had become but little diminished. It could be generally stated that all subjects severely affected and depressed before treatment died from intoxication caused by doses of the drug that only produced slight or even no untoward effects upon the less affected animals.

The following statements are given with regard to the action of the various drugs.

(1) Atoxyl, thiarsol, and tartar emetic in massive doses exerted a somewhat pernicious influence, hastened on the onset of death in the case of animals in low condition, and did not cure the others.

(2) Galyl, and novarsenobenzol in large dozes did not set up such immediate ill effects as would lead one to suspect the same pernicious influence.

(3) Arsenicals of all kinds appeared to give the best results when given in small repeated doses with the object of maintaining the strength of the animal and thus enable it to combat the causal organism.

[One would have been able to form a better opinion as to the value of the above important and summarily described piece of work if the protocols of the experiments had been appended.—Ed.]

Laveran (A.). **Grande fréquence de la kératite chez les chiens infectés par *Trypanosoma marocanum*; un cas de kératite ulcéreuse double.** [The Great Frequency of Keratitis in Dogs Infected with *T. marocanum*; a Case of Double Ulcerative Keratitis.]—*Bull. Soc. Path. Exot.* 1918. May. Vol. 11. No. 5. pp. 375–379.

As is well known, trypanosomiases are often accompanied in certain animals such as dogs, rabbits, goats, and horses by eye changes, characterised principally by opacity of the cornea. These changes have been described by Morax (1907). In the course of his study of *T. marocanum* Laveran was struck with the frequency and severity of keratitis in infected dogs. The Moroccan virus was obtained from two sources, viz., Casablanca and Mazagan (see this *Bulletin*, Vol. 6, No. 1, pp. 6–7). Velu observed opacity of the cornea in ten dogs out of 31 inoculated with the Casablanca virus. Delanoë noted the same complication in one dog out of three inoculated with the Mazagan virus. In his experiments the dogs used by Laveran probably were more resistent than those used by the above authors. Three dogs inoculated with the Casablanca virus showed lesions of keratitis in all cases. The first dog, which died 39 days after inoculation, showed complete opacity of the left cornea; the second dog also died 39 days after inoculation, showing opacity of the right cornea and haziness of the left cornea. In the case of the third dog dead 80 days after inoculation the keratitis became ulcerative in character during the last stage of the disease and one cornea perforated. This constitutes a rare form of trypanosome keratitis and a similar case has already been described by MORAX.

Out of five dogs inoculated with Mazagan virus four died with opacity of the cornea, complete in the case of three, and incomplete in the fourth. The dog dead with transparent corneae succumbed 24 days after inoculation whilst in the case of the other four dogs the course of the infection varied from 47 to 146 days. The short duration of the disease in the first of these dogs explains the absence of corneal lesions at the time of death; a few days before death this dog, however, was affected with double conjunctivitis which seems to indicate that the eyes were about to become infected when death supervened. The three dogs that died with both corneae entirely opaque succumbed in 47, 65, and 54 days, respectively. The dog that showed incomplete opacity of the cornea at the time of death succumbed 146 days after inoculation, but in this case an attempt at treatment produced a distinct effect upon the course of the disease and upon the corneal changes.

ITURBE (Juan). **El emético en el tratamiento de la derrengadera.** [Tartar Emetic in the Treatment of *Derrengadera.*]—*Gac. Méd. de Carácas.* 1918. Mar. 31. Vol. 25. No. 6. pp. 62–63.

The favourable results obtained after the use of tartar emetic by VAN SACEGHEM (1915) in the case of Congo cattle infected with *T. cazalboui*, and also by various authors in the case of human cutaneous and visceral leishmaniases induced the author to test the action of this drug on the trypanosomiasis of horses known on the plains of Venezuela as *derrengadera.*

Some preliminary experiments were first made on guinea-pigs artificially infected with virus obtained from the "plains" horses. After a number of passages a strain of virus of uniform virulence was obtained capable of causing death in the guinea-pig 10 days after intraperitoneal injection. In the tests of the drug guinea-pigs showing innumerable trypanosomes in the peripheral blood were always used. It was found that a dose, administered intramuscularly or intravenously, of from 4 to 5 milligrammes per kilo. body weight, caused the disappearance of the trypanosomes from the peripheral blood constantly within 15 minutes. No recrudescence of infection for several days after the treatment was found on examination of the blood; also blood withdrawn from an animal a week subsequent to treatment failed to set up the disease in a healthy guinea-pig. In some instances, however, relapses were observed on the third or fourth week after the first treatment, but these were found to yield to repeated injections of the drug. The dose of drug should be increased in the case of a very heavy trypanosome invasion. The laboratory animals were found to show a large degree of tolerance to the drug administered subcutaneously or intravenously. No accidents occurred in the course of the experiments. Although the trypanosomes in the peritoneal blood may be completely destroyed by a single injection of the drug it is known that those found hidden in the deeper tissue channels away from the circulating blood may remain quite unaffected. Repeated injections of the drug are therefore necessary in order to inhibit relapses.

Solutions of the drug were sterilised in the cold by passing through a Berkfeld filter. Encouraged by the results obtained in the course of the above experiments on laboratory animals the author endeavoured to perform some tests on horses affected with the natural disease. Five horses and two mules showing typical symptoms of the disease and large numbers of parasites in the peripheral blood were injected regularly every five days. The drug was administered intravenously in 1 to 1·50 gram doses dissolved in 100 c.c. of 0·4 per cent. common salt solution. No accidents occurred and all the animals recovered. It was found that the drug could be given even in 1 : 40 solutions without accident and with excellent therapeutic effect. Treatment of *derrengadera* on a large scale by means of tartar emetic is now being carried out.*

Van den Branden (F.). **Essais de traitement de la trypanosomiase humaine par l'émétique huileux.** [Treatment of Human Trypanosomiasis by Means of Oily Suspensions of Tartar Emetic.]—*Bull. Soc. Path. Exot.* 1918. May. Vol. 11. No. 5. pp. 379–382.

Suspensions of tartar emetic were made in olive oil, earth nut oil and liquid paraffin; the last-named product gives rise to a poor suspension. The drug was administered intravenously in 4 per cent. concentrations. No pain was experienced at the seat of injection in the patients treated but all suffered from a violent cough lasting from 15 to 30 minutes after the injection. This cough was less intense in subjects injected with the drug suspended in paraffin. As the result of his experience in nine cases the author concludes that oily suspensions of tartar emetic do not present any advantages over a watery solution of the same product, either from the point of view of therapeutic effect or in respect of the tolerance of subjects for large doses (pharmacodynamic action). The violent cough manifested immediately after the injection, the danger of intoxication as soon as one reaches doses that should prove efficacious, and the evident inefficacy of such high doses in a certain number of cases constitute sufficient evidence for rejecting this method of administering the drug from current practice in the treatment of human trypanosomiasis.

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* There appears to be a good deal of uncertainty concerning the identity of this disease. Translated literally from the Spanish the term *derrengadera* would be taken to refer to a condition of paresis or paraplegia affecting the hind quarters, and thus would be synonymous with the better known South American trypanosomiasis designated as *mal de caderas*, caused by *T. equinum*. According to Laveran and Mesnil [Trypanosomes et Trypanosomiases, 1912] a disease known as *desrengadera* affecting all classes of Equidae, dogs, and some wild animals on the Venezuelan plains was first studied by Rafael Rangel in 1905. This author claimed that the equines of Venezuela were affected with only one type of trypanosomiasis, which, however, became clinically manifested in two principal forms :—(1) Progressive pernicious anaemia (*peste boba*), with oedematous swellings (*hermosura*); (2) paresis or paraplegia (*desrengadera*). He concluded from a study of the symptomatology that the disease was identical with *mal de caderas*, although, as Laveran and Mesnil state, the presence of oedematous swellings has not been described in the case of that disease; moreover, Rangel did not consider that the presence of a well marked centrosome was an important factor for differentiating the causal organism from *T. equinum*. "Mesnil (1910) was enabled . . . to study a few smears of infected blood and convince himself that the Venezuelan trypanosome is morphologically different from *T. equinum*. It resembles *T. evansi* of surra. A fairly considerable variety of forms is seen, especially from the point of view of size: 'the average dimensions are 18 to 23μ by 1.7μ; but, certain elements reach up to 30μ.'' *T. equinum* measures 22 to 24μ long by 1.5μ broad. "Mesnil proposes, until fuller information is obtained to designate Rangel's trypanosome by the name *T. venezuelense*. "In addition to the resemblance with the surra organism, there is strong reason for instituting a comparison with *T. hippicum*, discovered by Darling in 1910 in the Equidae of Panama."

[Compare with the results obtained by van Saceghem (R.) and Nicolas (E.) in the treatment of animal trypanosomiasis with tartar emetic in the Congo (see this *Bulletin*, 1917, Vol. 5, No. 1, p. 21).]

Teague (Oscar) & Clark (Herbert C.). **A Trypanosome of Panamanian Cattle and a Method for Concentrating Trypanosomes in Peripheral Blood.**—*Jl. Infect. Dis.* 1918. Feb. Vol. 22. No. 2. pp. 154–158.

The authors showed that a large percentage of cattle brought to Panama City from various parts of the Republic of Panama harbour a large trypanosome in their blood. This trypanosome could not be found in smears made directly from the blood but developed in cultures grown at 26° C. In order to demonstrate its presence two c.c. of freshly drawn defibrinated blood were added to 10 c.c. of nutrient broth containing 0·85 per cent. sodium chloride. After 24 to 48 hours incubation the trypanosome could usually be detected in the upper layer of the sediment. On the third or fourth day they were generally present in large numbers occurring in clusters with flagella extending outwards and the posterior ends embedded in a central clump of leucocytes. The trypanosomes remain alive and actively motile in these cultures for 30 days or longer. After a few days, however, marked changes in morphology occurred, with the appearance of crithidial forms, some oval flagellated bodies and spermatozoon-like forms. In order to study the morphology of the organism as it occurs naturally in the blood the following method of concentration was adopted.

"The freshly drawn blood is whipped with wooden sticks in an enamelware cup and the defibrinated blood is poured through wire gauze to remove bits of fibrin. Ten c.c. of the blood are added to 10 c.c. of distilled water, and the two are thoroughly mixed. This was done at the slaughter house. Hemolysis of the red cells takes place in a few minutes. As soon as we reached the laboratory the blood was centrifugated, the supernatant fluid was poured off and the sediment was emulsified in the two or three drops of fluid remaining. Smears from this sediment showed well preserved trypanosomes in almost every instance, from 1–10 or 12 or more to a slide having been found. A drop of the sediment examined under a cover-slip occasionally showed a trypanosome, which remained actively motile for more than an hour after the distilled water had been added to the blood. There is a distinct advantage in defibrinating the blood before laking the red cells, as a smaller amount of distilled water is required, and the sediment after centrifugation seems to be smaller in amount."

The trypanosome was subsequently found in large numbers in the blood of a calf that had been inoculated seven days previously with a large dose of cattle blood. The trypanosome agreed in point of size and morphology with the descriptions given of *T. theileri*. On an average the organisms were about 45μ long (exclusive of flagellum) by 3·5μ wide, with a flagellum about 14μ. The posterior end was long, drawn out, and pointed. The undulating membrane was well developed, the blepharoplast was round and generally situated one quarter the length of the body of the trypanosome from the posterior end. The nucleus stained well and was centrally placed. The organisms found in a calf showing large numbers in its peripheral blood as the result of artificial infection were smaller in size than those seen in the case of cattle suffering from a chronic infection. The authors failed to infect a guinea-pig, a monkey, a pigeon, and a chicken with young cultures of the trypanosome, and, moreover, blood of cattle containing the trypanosome also failed to infect four guinea-pigs, one chicken, two pigs, one monkey, three opossums, one goat, and one mule, thus showing that failure to infect with young cultures was not due to loss of virulence. On the other hand a calf about four months old developed large numbers of the organisms in its blood 12 days after inoculation with the blood of cattle known to harbour the trypanosome; a little over three weeks later blood smears, however, gave negative results.

Filaria were also readily demonstrated in the blood of Panama cattle by the above-described concentration method although they could very rarely be found in ordinary blood films.

LANFRANCHI (A.). **Su di un nuovo genere di parassiti del sangue.** [A New Genus of Blood Parasite.]—*Ann. d'Igiene.* 1917. Nov. 30. Vol. 27. No. 11. pp. 697–699. With 4 text-figs.

In 1908 the author described a specific disease of pigeons produced by a haematozoon which he placed in the family of Mastigophora. On further examination of his preparations and drawings he considers that this parasite presented considerable morphological resemblances to the organism recently described by MARTOGLIO as occurring in the blood of a fowl in Eritrea, and placed by that author in a new genus—*Haemotrichomonas* [see this *Bulletin*, Vol. 6, No. 1, pp. 8–9]. The method of multiplication, however, apparently differed somewhat from that described by MARTOGLIO in the case of his parasite, which was said to multiply by longitudinal fission. In the parasite found in the pigeon multiplication appeared to take place by a process of schizogony. The nucleus divided into a number of small masses which migrated towards the periphery of the protoplasm of the mother cell; the protoplasm then became compacted around each small nuclear mass so as to produce a rosette-shaped appearance just before final division. The parasites studied by MARTOGLIO showed no evident pathogenicity. Lanfranchi's organism, however, was highly virulent for the fowl and also for rabbits and guinea-pigs. The author believes that MARTOGLIO was justified in creating a new genus for Trichomonas inhabiting the blood and thus the organism found to infest the pigeon is named *Haemotrichomonas columbae.*

LEISHMAN (William B.). **A Note on the "Granule-Clumps" found in *Ornithodorus moubata* and their Relation to the Spirochaetes of African Relapsing Fever (Tick Fever).**—*Ann. Inst. Pasteur.* 1918. Feb. Vol. 32. No. 2. pp. 49–59. With 2 figs.

In 1908 the author obtained a number of *Ornithodorus moubata* from Nyasaland and Uganda with a view to studying the course of events in tick fever in experimental animals. After several failures he eventually secured a batch of ticks which proved to be infective and by their bites produced in a monkey a typical attack of relapsing fever associated with the occurrence of large numbers of *Spirochaeta duttoni* in the blood. This strain of spirochaetes has since been maintained in mice by means of inoculation or by the bites of infected ticks. In previously published papers (1909–1910) the author thus dealt with the fate of spirochaetes ingested by the ticks, the nature of the hereditary transmission of the infection in the tick, and the mechanism of infection by the bite of the tick.

The present note records recent observations tending to lend still further support to the author's contention that some at least of the granule clumps almost constantly found in various tissues of the tick and in the eggs of the ripe female are derived from spirochaetes and are able subsequently to regain their original spirochaete appearance. These clumps would therefore represent a stage in the development of the spirochaete in the tick. It was found that spirochaetes after ingestion by the tick retained their motility for several days, the period depending chiefly on the temperature at which the ticks had been kept. Subsequently they lose their motility and tend to agglomerate into masses which, when stained, are seen to consist of spirochaetes the chromatin in which has broken up into a number of deeply staining segments or granules. Others, however, behave differently and develop a lateral or terminal body which then apparently separates and corresponds to an isolated granule clump. Still later there occurs a period of a few days during which either no spirochaetes at all can be detected or only rare ones that are seldom motile. Next, and especially in the case of ticks that have been kept at comparatively high temperatures, there appears a sudden re-infection of the tissues with numerous and vigorously motile spirochaetes, often very different in size and general appearance from those that were originally ingested by the tick. These so-called young forms are very much shorter than the others, the smallest being from 3 to 4μ in length and showing only two or three curves.

In the course of several experiments it was found that this second group of spirochaetes disappeared more or less completely and six or seven days later a repetition of the above events occurred; in other words, regular relapses appear to take place in the body of the tick as regards the appearance and disappearance of spirochaetes, just as in the case of the warm blooded host.

DISEASES DUE TO METAZOAN PARASITES.

Schwetz (J.). **A Comparative Study of the Habits of *Glossina brevipalpis*, Newst., *G. fusca*, West., and *G. pallidipes*, Aust. in the Belgian Congo.**—*Ann. Trop. Med. & Parasit.* 1918. May 11. Vol. 11. No. 4. pp. 365–398. With 1 map & 1 chart.

Comparatively little is known about the habits of *Glossina fusca* and *G. pallidipes* although those of *G. brevipalpis* have been more fully investigated; the lack of knowledge may be explained by the comparative rarity of the former species. However, according to the author, where *G. fusca* occurs it is frequently not at all uncommon but still it does not swarm in such large numbers as *G. brevipalpis*. *G. pallidipes* also may be found in large numbers, sometimes almost as great as those of *G. morsitans* when one has obtained knowledge regarding the habits of the species. It has been stated that *G. brevipalpis* is much restricted in its distribution but the author's observations suggest that it is in reality to be found over large tracts of country. The observations recorded in this paper were made for the most part in the Agricultural Station of Katompe where there are coffee plantations. This station (in the Province of Katanga, Tanganika-Moere District) is situated almost midway between the river Lualaba and the river Lomami, slightly south of the 6th S. parallel and about 26° 50. E. long. Three months (February to April 1916) were devoted to the work and the observations made were controlled and completed by expeditions taken to the same district:—(1) from Katompe district to Kabalo and return; (2) Katompe to Kongola; and (3) Kongola to Kabinda. All the observations were made during the rainy season, circumstances preventing observation during the dry season. In previous articles on *G. morsitans* and *G. palpalis* the author has insisted upon the importance of the various types of vegetation in determining the distribution of tsetse flies in general and one or another species in particular. The main types of tropical African vegetation may be grouped in three classes:—(1) forest; (2) woods or park land; and (3) savannah, and the last-named class may be sub-divided into grassy savannah and wooded savannah. These types are not sharply separated from one another and areas exist in which the vegetation is intermediate or transitional in type, so that qualification of the above terms is sometimes necessary in describing a particular spot. It has previously been pointed out by the author that although all tsetse require shade and are therefore never found in the stretches of grassy savannah different species require different kinds of vegetation. Thus *G. morsitans* only occurs in park land while *G. palpalis* is only found near water bordered with forest. The investigations recorded in this paper were undertaken, however, in order to discover, *inter alia*, the types of vegetation necessary for *G. brevipalpis*, *G. fusca* and *G. pallidipes*; whether these flies are capable of adapting themselves to any kind of arborescent vegetation—be it forest park or wooded savannah, or whether all or any of them require one of these three types. A further object also was to determine the importance of water as a factor influencing their distribution.

The distribution of the flies and the vegetation of the various regions are traced on the map and chart given.

The following summary and conclusions to his investigations are given by the author.

(1) "The five important tsetse-flies—*G. brevipalpis*, *G. fusca*, *G. pallidipes*, *G. morsitans* and *G. palpalis*—select tree trunks, the larger branches of trees and lianes for resting purposes.

(2) "In regions where they exist, *G. brevipalpis* and *G. pallidipes* are not restricted to limited areas or belts, but, like *G. morsitans*, are found uninterruptedly—except in large clearings— over vast stretches of country.

(3) "The habits of *G. pallidipes* are intermediate between those of *G. brevipalpis* and *G. morsitans*. Like *G. brevipalpis*, *G. pallidipes* hovers

over the ground when active and is usually so only at certain fixed times, especially between 3 p.m. and 5 p.m. (4 to 6 p.m. with *G. brevipalpis*), the maximum activity being reached about 4 p.m. The habits of *G. pallidipes*, however, are less well defined than those of *G. brevipalpis*, and it not only appears and bites more often than the latter, but is not uncommonly seen on the wing in very small numbers throughout the whole afternoon and occasionally in the forenoon. Of the *G. pallidipes* captured when active, only about 15 per cent. were females.

(4) "In those regions where *G. brevipalpis* occurs it accommodates itself to all types of arborescent vegetation—forest, park land and wooded savannah, but *G. pallidipes*, like *G. morsitans*, does not inhabit the forest.

(5) "*G. fusca* occurs only in one kind of arborescent vegetation—forest. As the region where these observations were made (northern Katanga, notably the districts between the River Lualaba and the upper Lomami River) consists of park land and savannah, the forest only being represented, usually along rivers and streams, by belts of varying width, it is evident that in this region *G. fusca* only occurs in limited and somewhat restricted areas. Further, these areas are still more restricted owing to the fact that this species only inhabits moderately dense forest belts of a certain width (200 to 300 metres). But contrary to what has been thought so far, where *G. fusca* does occur it is not at all uncommon, and sometimes it is quite abundant. However, it has peculiar habits—it does not fly during the day like *G. morsitans* and *G. palpalis*, it does not hover over the ground at definite times like *G. brevipalpis* and *G. pallidipes*, but always remains motionless on tree trunks and lianes. Occasional specimens, usually one or two, are sometimes attracted by men and animals passing by. These may make their appearance at any time of the day, but prefer the cooler hours, e.g., early in the morning or more often late in the evening. But *G. fusca* also has a definite period of activity, viz., from 7 to 8 p.m., or one to two hours after sunset, and if a haunt of the fly be passed during this time numerous attacks are sure to be made.

(6) "Females of *G. fusca*, unlike those of *G. brevipalpis* and *G. pallidipes*, are commonly found, and form nearly 50 per cent. of the specimens captured—whether the flies be taken on the wing or resting on trees, etc.

(7) "Since forest belts usually occur near water, it is in the neighbourhood of the latter that *G. fusca* is generally found, but *G. fusca* also occurs in forest belts where there is no water in the immediate vicinity, and may even be found in forest a few kilometres distant from the nearest water. In this respect, therefore, *G. fusca* is unlike *G. palpalis*, but resembles *G. pallidipes*, *G. brevipalpis* and *G. morsitans*.

(8) "The haunts of *G. brevipalpis*, *G. pallidipes* and *G. fusca* are situated almost exclusively along the roads and paths."

The following figures illustrate the proportions of the sexes of the various tsetse flies :—

(1) "Of 165 specimens of *G. fusca* captured at Katompe in February (a few of which were taken on the wing), 88 were males and 77 females.

(2) "Of 255 specimens of *G. fusca* captured at Katompe in March, 143 were males and 112 females.

(3) "Several species of tsetses captured one morning on tree trunks between Masembi and Musinga Lenge were divided as follows :—

(*a*) 27 *G. brevipalpis*, 21 males, 6 females.
(*b*) 4 *G. pallidipes*, 3 ,, 1 ,,
(*c*) 7 *G. fusca*, 4 ,, 3 ,,

(4) "Of 344 *G. pallidipes* captured at Katompe from February to March, 281 were males and 63 females.

(5) "Of 237 *G. pallidipes* captured on the Katompe-Kabalo route in February, 193 were males and 44 females.

(6) "Of 509 *G. morsitans* captured on the same route during the same journey, 304 were males and 205 females.

(7) "Of some 5,000 *G. brevipalpis* captured at Katompe and elsewhere, only 50 were females, and of these about 75 per cent. were captured on tree trunks."

DUNN (L. H.). **Studies on the Screw Worm Fly,** ***Chrysomyia macellaria*** **Fabricius in Panama.**—*Jl. Parasit.* 1918. Mar. Vol. 4. No. 3. pp. 111–121.

The screw worm fly occurs in great abundance throughout the Canal zone and the Republic of Panama, and owing to its dangerous habit of depositing its eggs on living as well as on dead tissues of man and the lower animals is of considerable economic importance. The number of eggs laid in one batch by a single fly varies considerably but in favourable circumstances averages 190. On dead animal matter the females show a tendency to lay their egg masses together in a heap. The time required for the eggs to hatch varies from 11 to 23 hours, the average being about 14 hours. Surrounding conditions of moisture and the temperature exert very little influence inasmuch as they are nearly always the same in Panama, though the time may be shortened owing to the action of the body heat when the eggs are deposited on living tissues. The growth of the larvae is very rapid, approximately 2 mm. a day until they become mature on the 5th or 6th day. The pupal period usually lasts from 4–5 days and among the emerging adults there is little disparity between the sexes. The adult flies exist on fluids or semi-fluids in material that can be reduced to a semi-liquid food, such as the garbage found near habitations and decaying plant and animal substances in the woods and jungle.

The females seem to prefer the late afternoon or evening to deposit their eggs but it is not known whether they remain active after nightfall in search of suitable places. Most flies become inactive at nightfall, but this species has been observed to deposit its eggs during the night while in captivity and when gravid females are captured and placed in breeding jars they lay their eggs much more readily if the jar is covered with a dark cloth than if it is left uncovered. In Panama the fly seems to be entirely impartial in its choice of environment; the females are very active, always searching either for food or for a place to lay their eggs, and in the jungle they are quickly attracted by any animal, probably by its odour.

Throughout the Isthmus of Panama this fly by means of its larvae causes a greater amount of damage and suffering to cattle, horses, and other animals than any other dipterous pest and, if one excludes the disease bearing mosquitoes, the same remark applies to man. The disorders caused by the larvae in man are described at length.

Nearly all kinds of domesticated animals and some of the wild animals are subject to attack by this fly. It has recently been discovered that it will deposit its eggs in the nostrils of perfectly healthy dogs. In one case observed in a deerhound considerable damage was done by their eating through the tissues surrounding the nostrils into the mouth; the dog recovered after removal of the maggots, but it was subsequently found that they had caused a loss of bones in the upper right half of the mouth and nose, loss of teeth in the upper right jaw, and partial or complete loss of smell. The dog was of no further use in hunting owing to the loss of its sense of smell. The screw worm may be classed as an important enemy to dogs on the Isthmus, not only owing to the loss of tissue brought about directly by it but also on account of the secondary bacterial infections which often follow attacks of myiasis and cause death.

On account of their persistent habit of licking all wounds within reach cats are seldom infested, but one cat was observed with two fully grown screw worms in an open wound situated just behind the ears. The worms have also been found on neglected spur wounds on fighting cocks. Three tame deer kept at the laboratory became infested from very insignificant wounds. One male became attacked as the result of a skin abrasion caused by tying a rope around the horns. The second one became infested as the result of a small punctured wound near the hock produced by a nail; the external opening remained very small but a deep cavity formed underneath which was found to contain 52 larvae. The third deer developed maggots on a small wound on the nose caused by running against the fence.

If an animal dies and is left unburied for a few hours it is evident that many eggs become deposited within the natural orifices and also if time is given for the eggs to hatch the cavities will contain many young larvae that will be buried with the carcase. Even if the eggs are not hatched before burial their hatching is delayed but little and the young larvae emerge as readily underground as on the surface. Experiments performed in order to investigate the depth at which the larvae may be buried and emerge from the surface as adults showed that 56 per cent., mostly females, emerge when buried at a depth of 2½ feet, the flies appearing on the surface from the 10th to the 14th day after burial. The author states that when the carcases of dead animals are buried it is seldom that they are covered with more than 2½ feet of earth. The percentage of flies that would emerge when the carcase was buried at a smaller depth would be proportionally greater.

There is as yet no positive evidence incriminating this species of fly as a disease-transmitting agent, but research in this direction is necessary, especially as regards the transmission of anthrax among cattle. In localities where the screw worm flies are numerous they are seen attracted to an animal dead of anthrax. In such cases they are found either feeding on the discharged fluids on the ground or about the head of the animal, or are busy depositing their eggs about the natural orifices or other places where there is sufficient discharge to produce a moist surface. In Panama the buzzards locate the body of an animal soon after death and after a few of these scavengers start feeding on a carcase it presents better opportunities for the flies. The author gives as an illustration the facts with regard to the carcases of three steers dead of anthrax observed by him on a pasture.

> "They had been dead only a few hours but had began to bloat and a strong odor of decomposition was emanating from them. A veritable swarm of screw worm flies was feeding and ovipositing on each carcass although they were nearly a mile apart. When these flies either feed or oviposit on a carcass the feet and proboscis must necessarily become contaminated and . . . are capable of infecting any animal that they may visit shortly after; that is, providing the animal happens to have a fresh brand mark that is unhealed, cuts from barbed wire, horn wounds, or any skin abrasions . . . this fly may be one of the principal carrying agents in tropical and sub-tropical countries."

With regard to preventive and control measures tests were made with different drugs in order to determine their respective lethal effects upon the screw worm. The most effective agents were fat solvents which readily penetrated and dissolved the fatty tissue of the larvae. Owing both to the great diversity of the breeding habits of this fly and owing to the peculiar conditions existing in Panama but little can be said with regard to its control.

In treating animals with infested wounds all open lesions may be sprayed with chloroform or carbon tetrachloride to remove the maggots. Both of these substances have proved efficacious. Carbon tetrachloride is quite as fatal to the maggots as chloroform, it is equal in penetrating power, it does not evaporate any more readily, it produces no more irritation to the tissues, does not retard healing any longer, and is much cheaper. Carbon tetrachloride does not attract the flies by its odour as the carbon bi-sulphide is said to do and it is not inflammable like the latter substance. Deep punctured wounds are best treated by first spraying with glycerine in order to cause the maggots to become more active and approach the external orifice of the wound. They may then be sprayed with carbon tetrachloride to destroy them. If one of the lethal fat solvents is injected into a deep wound in an undiluted state the larvae are apt to be destroyed *in situ* and subsequently cause suppurative changes. After a wound on an animal has been rid of all screw worms it should be dressed with some repellent agent such as pine tar to keep the flies from depositing more eggs on the wound. The author strongly recommends as a protective dressing a mixture of equal parts of beeswax, fish oil, and carbon tetrachloride, with enough vaseline added to give it the proper consistency. If all animal wounds, both those which are fresh and those from which the screw worms have been removed, are painted with this mixture it will prevent the flies from depositing their eggs and save the cattle from damage as well as reduce the number of flies. The author then gives instructions with regard to the prevention of myiasis in the human subject.

Dove (W. E.). **Some Biological and Control Studies of** *Gastrophilus haemorrhoidalis* **and other Bots of Horses.**—*U. S. Dept. Agric.* Bull. No. 597. 1918. Apr. 9. 52 pp. With 5 plates & 4 text-figs. (Professional Paper.) 1918. Washington: Govt. Ptg. Office.

"Three species of horse bots—the common bot-fly (*Gastrophilus intestinalis*), the throat bot-fly (*G. nasalis*), and the nose fly (*G. haemorrhoidalis*)—occur in the United States, and each is a source of considerable injury to horses. This injury is produced through worriment caused by the flies at the time the eggs are laid and by the attachment of the larvae, or bots, in the alimentary tract.

"*Gastrophilus intestinalis* and *G. nasalis* are widely distributed in the United States but *G. haemorrhoidalis* is confined to the North Central and northern Rocky Mountain States.

"The nose fly (*G. haemorrhoidalis*) is by far the most annoying to horses at the time its eggs are laid. The adults appear early in June and reach the maximum of abundance during the first half of the season, disappearing with killing frosts. The eggs are deposited on the minute hairs on the lips, and those near the edges which are kept moist and receive friction hatch in from 5 to 10 days. The larvae are taken in with food or water and attach themselves to the walls of the stomach. Here they remain until the following winter or spring and then migrate to the rectum, where they reattach. Before leaving the host they usually attach close to the anus and protrude from it. They remain in this position from 40 to 71 hours. After dropping to the ground the bots seek protection and pupate in from 18 to 170 hours later. The pupal stage lasts from 21 to 68 days. The adults are very active, and as they deposit only one egg at a time they are not so frequently seen about horses as are the adults of the common bot-fly. They take no food in the adult stage. Their length of life is from 1 to 7 days.

"The throat bot-fly (*G. nasalis*) deposits its eggs on the hairs under the jaws and to some extent on the shoulders and other parts of the host. The larvae of this species attach themselves to the walls of the pharynx and also to those of the stomach and duodenum. They do not reattach in the rectum or at the anus as do the bots of the nose fly. Pupation occurs in from 1½ to 2 days after the larvae have passed from the host, and adults emerge in from 20 to 56 days later. The adults are somewhat longer lived than those of the nose fly. The flies cause considerable annoyance to horses during oviposition but not as serious as in the case of the nose fly.

"The common bot-fly (*G. intestinalis*) usually appears later in the season than the nose fly and becomes most abundant just before killing frosts. The eggs are deposited on all parts of the body, but preferably on the fore legs. They hatch upon the application of moisture and friction. From 9 to 11 days after oviposition appears to be the most favorable period for hatching, although some may hatch as early as 7 days and others as late as 96 days after oviposition. The larvae attach in any part of the stomach, but the last-stage bots are found mostly in the left sac. They continue to drop from the host for a long period of time. Pupation takes place in protected places on the surface of the soil and the pupal stage lasts from 40 to 60 days.

"All Gastrophilus larvae are surprisingly resistant to chemicals. The treatment of horses with carbon disulphid in three doses followed by a physic is satisfactory if administered in the late fall. Spring treatment is less effective, as the full-grown larvae are more resistant, and many of the nose-fly bots have left the stomach and passed back to the rectum at that time.

"Larvae of *G. haemorrhoidalis* may be removed from the rectum mechanically, but this is laborious. The use of enemas containing insecticides is ineffective.

"As a repellent, pine tar mixed with other material gave good results against the common bot-fly and the throat bot-fly. Such mixtures may be utilized to cause the flies to lay eggs on parts of the body less accessible to the horse's mouth.

"Various nose protectors are in use against *G. haemorrhoidalis*, but there are objections to many of them. A piece of leather suspended below the lips from the bit rings is simplest and best. For animals on pasture a halter with a box-like arrangement and throat cover has been devised to protect horses against infestation by all three species.

"Kerosene oil used as a wash is ineffective in destroying the eggs of Gastrophilus, but certain other substances have given good results. Carbolic acid containing 2 per cent. phenols is satisfactory for destroying eggs when applied to the infested parts of the host."

LAMSON, Jr. (G. H.). **The Life-Histories of the Cattle Lice.**—*Jl. Econcm. Entom.* 1917. Aug. Vol. 10. No. 4. pp. 446–447.

"The life-histories of these species have been worked out during this winter. Ten specimens of the short-nosed ox louse (*Haematopinus eurysternus*) were placed on a restricted region on the shoulder of a Holstein calf that was less than twenty-four hours old. The white eggs were soon laid. These were observed once each day and the eggs hatched in from seven to eight days after they were laid. These young were removed and placed on another calf and these laid eggs in from fifteen to sixteen days after hatching, making a life-cycle of from twenty-two to twenty-four days. The female of this species lays from thirty-five to fifty eggs each. The life-history was checked on other calves.

"The life-history of the long-nosed ox louse (*Haematopinus vituli* Linn.) was very similar though it was slightly longer. The method used was the same as in the previously mentioned louse. These insects were placed in a white patch where the shining black eggs hatched in from eight to nine days and the lice again laid eggs in from seventeen to eighteen days after hatching, making a life-cycle of from twenty-five to twenty-seven days.

"The little red biting lice (*Trichodectes scalaris* Nitz) have been much harder to determine owing to the difficulty in keeping them confined. From the writer's observations supplemented by the hatching of eggs in an electric incubator it is believed that they hatch from the eggs in from five to six days and mature in two weeks though more work must be done on this species to determine its life-cycle with the accuracy of the two previously mentioned species. This would indicate that a treatment might be repeated with the best results from ten days to two weeks after the first treatment.

"The experimental work on the control measures will appear in the future in a bulletin from the Storrs Experiment Station."

Herms (William B.). **Contribution to the Life-History and Habits of the Spinose Ear Tick,** *Ornithodoros megnini.—Jl. Econom. Entom.* 1917. Aug. Vol. 10. No. 4. pp. 407–411.

A description of habits, life history, and conditions set up by the above tick in the Union of South Africa has already been noticed at some length in the preceding number of this *Bulletin*, [Vol. 6, No. 2, pp. 84–85, Bedford (G. A. H.)], and measures for its eradication were outlined. According to Herms

"the Spinose Ear Tick presents a problem of considerable importance to the animal husbandryman in nearly all of the southern half of California, particularly in the Imperial Valley, where calves become seriously infested and die from what the ranchers call 'Tick Fever.' Experiments and field observations on this species have been carried on more or less continuously by the University of California Laboratory of Parasitology during the past three or four years. From our records it would seem that few, if any, warm blooded animals coming within reach of this tick are exempt from attack. Calves evidently are most liable and suffer most severely, many dying from the effects.

"Infested calves shake the head vigorously, become emaciated, often race about madly until completely exhausted. The ears become inflamed and the secretion of wax is greatly stimulated. Deafness is said often to result in infested horses and mules."

An account is given of a case in which a man became infested through sleeping on the ground at night alongside cattle ranges or pastures. The tick almost certainly entered the man's ear as a larva and about nine weeks later a fully grown female was extracted from the auditory meatus. The man had complained of intermittent noises in the affected ear. The female remained alive without food at room temperature for nearly a year.

In order to ascertain the exact time expiring between the last moult and the deposition of eggs a number of females that had not undergone their final moult were placed in Petri dishes with one or two males and kept in an insect cage at 26 ± 3° C. One of these females, after about 60 days, was subjected to a temperature as low as 0° C. It was found that copulation took place readily within a day or two of the last moult and that in six cases egg deposition began in from 14 to 42 days after copulation or from 15 to 44 days after the last moult, the number of ova varying from 7 to 562. The longest period of oviposition noted was 155 days, or 189 days after moulting.

A few experiments were made in order to find the length of the incubation period. It was found possible to secure oviposition during the winter months (November and December) under laboratory conditions and the eggs were found to hatch at a room temperature of about 21° C., requiring from 18 to 23 days incubation. Under field conditions this, however, takes place during the summer and autumn months.

In a series of experiments in which the larvae were kept in darkened receptacles at room temperature, during the months of November, December and January, it was found that the range of longevity was from 19 days, the shortest, to 63 days, the longest, with an average of 44 days. This series included seven sets of larvae hatching during a period of 32 days.

THOMSON (F.). KEOGH (F.) & TUCKER (George). **Eradication of the Cattle Tick. Observations on the Efficacy of the Tick-Destroying Mixtures Approved by the Queensland Stock Department, According to the Method and the Thoroughness of their Application.**—*Queensland Agric. Jl.* 1917. Dec. Vol. 8. Pt. 6. pp. 302–307. With 1 table.

The Queensland cattle tick *Margaropus* (*Rhipicephalus*) *annulatus australis* is a one-host tick spending the whole of its parasitic life, approximately 21 days, on one animal. Under favourable weather conditions the fully engorged tick commences to lay eggs in 3 days after dropping off from its host and in from 10–21 days it may lay from 15,000 to 3,000 eggs. The eggs hatch in from 21–42 days and owing to the small size of the larvae an early infestation is easily overlooked and a susceptible cow may die of redwater before the ticks are sufficiently grown to be readily detected. On the other hand the further development of the ticks on immune animals furnishes the means of propagating the infection. Highly successful results have been obtained in Queensland for about 20 years by dipping cattle in fluids containing 0·2 per cent. of arsenic (8 lbs. of arsenic per 400 gal. of water containing emulsifying agents). There has been a tendency among stockowners of late years to reduce the amount of arsenic, to substitute spraying for dipping, and neglect to have samples of dip properly analysed. The authors briefly describe some experiments in which the difficulty of killing off the ticks by means of even careful spraying is demonstrated. After 12 months experience with this method it was concluded that spraying occupied too much time and was not sufficiently reliable to enable one to maintain a pasture absolutely clean. Consequently a dipping tank was installed for experimental purposes.

A dip was prepared according to the Department's formula as follows:—

Commercial arsenic	8½ lbs.
Caustic soda	4 ,,
Stockholm tar	½ gallon
Water	400 gallons

The dipping vat at working level held 2,800 gal. and was charged as follows:—2,000 gal. of water were run into the vat; 59½ lbs. of commercial arsenic were mixed with 14 of caustic soda in the dried state and placed in a 400-gallon tank with about 20 gal. of water, the mixture being stirred for a few minutes until the ingredients boiled and the arsenic dissolved. Cold water was then added until the tank was full when the mixture was well stirred and run into the dip. Next 50 gal. of water were run into the tank and heated to boiling point; 14 lb. of caustic soda and 28 lbs. of tallow were then added and boiled together for ¾ of an hour. Cold water was then gradually added, the heating being continued but the fluid was kept below boiling point. When the tank was half full 3½ gal. of Stockholm tar were added and the mixture well stirred. Heating was continued and water gradually added until the tank was full, when the mixture was thoroughly stirred and run into the dip. The whole of the contents of the vat was then thoroughly stirred and used for dipping cattle. Dipping of all cattle running in the paddocks was performed every 14 days with highly satisfactory results, no discomfort being experienced by the animals either in summer or in winter. The results of five carefully conducted experiments to demonstrate the efficacy of this method for tick eradication are indicated in the table.

The authors' conclusions are as follows:—

"There is a very striking difference in the efficacy of tick-destroying fluid according as this is applied by dipping or spraying. Spraying is so unreliable that its use for treating tick-infested or suspected cattle before travelling into clean country should not be countenanced when a suitable dip is available. If spraying is unavoidable, the cattle should be sprayed as often as necessary and held in a clean place until they are proved by the most careful inspection to be clean, and the inspector examining same should be sufficiently experienced to realise the great difficulty of detecting the presence of a very limited number of ticks, more especially when the hair is long."

van Saceghem (R.). **Contribution à l'étude du *Gastrodiscus aegyptiacus* (Cobbold 1876).**—*Bull. Soc. Path. Exot.* 1918. May. Vol. 11. No. 5. pp. 396–397.

The study of the above parasite was undertaken by van Saceghem at the Bacteriological Laboratory, Zambi, Lower Belgian Congo. The eggs were easily found in quite fresh faeces from horses and were of large size, 150–170μ long by 90–95μ broad. No segmentation can be observed within the egg after oviposition, except in the centre where a polyhedral mass may be seen. At laboratory temperature (average 28° C.) the egg contents after three weeks become very granular in appearance. The presence of humidity is by no means necessary. Segmentation can take place equally well in a dry environment. The central mass inside the egg soon undergoes retraction which is very marked at the two poles. A few days later a small vermicule can be distinguished showing intermittent movements inside the egg. The vibratory movements of the cilia can be quite well seen. The anterior extremity of the ciliated larva is found opposite the micropyle of the egg. The obstruction at the opening is then found to give way and the larva escapes into the outside world. If the necessary amount of humidity is not available the miracidium quickly dies. On the other hand this stage shows rapid translatory movements in water; if an obstacle bars its way the ciliated larva throws itself into a ball and progresses by means of creeping movements. The morphology of the Gastrodiscus miracidium is similar to that of any other miracidium. The ciliated larva is 164μ long by up to $73{\cdot}8\mu$ broad. The anterior extremity is blunted, whereas in the case of *Fasciola hepatica* it is pointed.

The question arises as to whether there is a certain intermediate host in which the miracidium develops into sporocysts. If one takes into account the large number of horses infested, the rapidity with which the parasite becomes distributed throughout a country, and the enormous number of Gastrodiscus that may be found in the intestine of horses one may conclude that the miracidium gains easy access to large numbers of the intermediate host; this consequently must be very common and is probably a mollusc found in abundance in marshy land. As a rule the infection produced by *Gastrodiscus aegyptiacus* does not give rise to any serious symptom. However, in certain circumstances, especially when the horses are debilitated as the result of some disease or insufficient food, the parasitic invasion may bring about serious complications and progressive anaemia, leading finally to death. Horses badly infested frequently show signs of colic, which disappear after the administration of a dose of laudanum to which is added some ether. There is no specific treatment against the infection. Arsenic even when administered in large doses does not cause the amphistome to disappear. The only means of preventive treatment that can be adopted is to prevent horses from drinking water from marshes and to forbid the use of grazing land in their vicinity. Also, horses should not be fed in the stable with fodder cut close to the marshes.

RAFFENSPERGER (H. B.). **Experiments in the Transmission of Trichinae.**—*Jl. Amer. Vet. Med. Assoc.* 1918. June. Vol. 53. (New Ser. Vol. 6.) No. 3. pp. 363–367.

"In the literature of trichinosis, statements are occasionally seen that infection may be brought about by the ingestion of feces or the intestinal contents of animals harboring the intestinal stage of the parasite. From time to time the results of experiments have been recorded which it is claimed demonstrate the transmission of the parasite in this way. Höyberg (1907) for example concluded that infection may result from the swallowing of feces or intestinal contents of infested animals, and recently Salzer (1916) reported infection from feeding the feces of infested dogs. Various highly competent investigators, however, including such well-known authorities as Leuckart and Pagenstecher have reached the conclusion that infection cannot be brought about through the swallowing of intestinal trichinae or the newly born larvae which may occasionally be found in the feces of animals during the time when adult trichinae are present in the intestine. A few years ago, Stäubli (1909) reported a series of experiments in feeding to white rats the intestines of rats and guinea-pigs containing trichinae in various stages of development and his results were consistently negative."

In the course of investigations upon trichinae undertaken by the writer under the direction of the United States Bureau of Animal Industry some experiments similar to those of STÄUBLI were carried out and negative results were likewise obtained in all cases.

"Concerning the stage at which trichinae in the muscles become infectious it is usually stated in the literature that non-encysted trichinae are not infectious. Leuckart (1860) fed a dog with muscles of a young girl containing trichinae none of which so far as observed were yet encysted. After seven days the dog was killed and its intestine was found to contain trichinae. He therefore concluded that encystment is not a necessary condition for the further development of Trichinella. It is questionable, however, whether there might not have been also encysted trichinae present in the muscle fed. Pagenstecher's experiments (Pagenstecher, 1865) throw more light on the subject, since he gives definite information concerning the age of the trichinae which he fed. Trichinous rabbit meat seventeen days after artificial infestation of the animal from which it was taken was fed to rabbits which were killed within 24 days and found to be free from trichinae. Trichinous meat from a mouse 15 days after artificial infestation failed to produce intestinal trichinosis in a rabbit which was killed 4 days after feeding. Similarly, pigs escaped intestinal trichinosis after eating rabbit meat 14 days after artificial infestation. However, another pig was fed on rabbit meat 18 days after artificial infestation and when killed 9 days after feeding was found to contain small intestinal trichinae, the males measuring 0·9 mm. and the females 1·75 mm. in length. In one experiment he reports a successful infestation of a rat as a result of feeding mouse meat 15 days after artificial infestation. The rat was killed 4 days after feeding and was found to contain in the intestine 3 females with a maximum length of 1·45 mm. and 2 males. He also observed that copulation has already taken place. This experiment is open to objection, however, since the same mouse had been fed on trichinous meat about three weeks previous to the infestation on the basis of which the age of the infection was computed. Pagenstecher after killing the mouse concluded that the first infestation must have been unsuccessful since he found only unencapsuled trichinae in the muscles. It is not unlikely, however, that the muscles contained encysted trichinae from the first infection, which were overlooked, and that it was these which developed into the adults found in the rat.

"Goujon (1867) states that as a result of feeding trichinous meat containing non-encysted trichinae he succeeded in producing light infestations in various animals. He admits the possibility that some of the trichinae may have been encysted and concludes that the infestations produced as a result of eating meat containing unencysted parasites are much lighter than those which follow the eating of meat containing encysted trichinae."

A small number of rabbits and guinea-pigs were fed by the author with trichinous meat and killed at various intervals after feeding. The diaphragm and in some cases portions of other muscles were subsequently fed to other rabbits or guinea-pigs which were killed after certain intervals and examined as to the presence of trichinous infestation. The results showed that no infection was produced by feeding meat containing unencysted trichinae taken from animals killed 15, 17, and 18 days after infection, respectively, but infection resulted from meat containing newly encysted trichinae taken from an animal killed 21 days after infection.

"The evidence obtained from the experiments supports the generally accepted opinions that trichinae are not transmissible through the feces, that unencysted trichinae are not capable of development when meat containing them is ingested, and finally that trichinae are spread from one host to another only as a result of the swallowing of meat containing the encysted larvae of the parasites."

LEWIS (J. C.) & SEDDON (H. R.). **Habronemic Conjunctivitis.**—*Jl. Comp. Path. & Therap.* 1918. June. Vol. 31. Pt. 2. pp. 87–92. With 2 text-figs.

In their introduction the authors state that in Australia "the occurrence of Habronema in the skin and subcutaneous tissues has appeared of recent years to be more common or, at least, it has been much more frequently noticed, and may be assumed to be becoming more widespread or more various in its manifestations, and probably of more importance in its effects."

"As mentioned in Railliet's report [see this *Bulletin*, 1916, Vol. 4, No. 3, pp. 102–105] Ercolani was the first to discover in 1859 a larval nematode (*Habronema megastoma?*) in the subcutaneous fibrous tissue of some of the skin lesions which in the horse are generally known as summer sores or granular dermatitis. Others, including Buffard, Rivolta, Favet, and Moreau, have also described similar conditions. In India a somewhat similar condition is often confused with other cutaneous lesions caused by moulds, and possibly other agents, under the general term bursati. More recently the work of Descazeaux [*see* also passages of *Bulletin* referred to above], on Esponja or Summer Sores of Equines in Brazil has been the subject of the report by Railliet mentioned above.

"Bull [this *Bulletin*, 1916, Vol. 4, No. 4, pp. 166–168] has described at length, under the term habronemic granulomata, a somewhat similar condition which is usually situated about the urethral orifice and the sheath of equines; in one instance lesions were also present in the metacarpal region, and in another on the hock."

One of the authors (Lewis) described in 1914 equine granuloma in the Northern Territory of Australia (swamp cancer), which condition is considered by Bull to have the same histological picture and to be "almost certainly a variation of the same condition" described by himself.

The authors then give details regarding four cases of the above condition. The lesions in these cases were as follows:—(1) a granulomatous mass involving the inner canthus of the eye and the membrane; on closer examination fine miliary necrotic areas were found on the conjunctiva of the lower lid; a year later a similar condition recurred in both eyes. (2) Small yellow necrotic areas on the membrana nictitans and the conjunctiva of the lower lid of both eyes. (3) Many small whitish scars producing some puckering on the conjunctiva. The necrotic areas had probably been absorbed. (4) Granulomatous mass presenting small caseous areas some of which were partly extruded from the surface at the inner canthus, numerous whitish scars over the membrana nictitans; a tumour was also present on the shoulder about the size of a hen's egg with numerous discrete shot-like masses around its periphery. The lower lid was also oedematous in these cases and lachrymation was marked in two of them.

The lesions on section were found to contain minute yellowish areas of necrotic tissue varying greatly in shape; the spherical masses measured about 0·25 mm. in diameter, the cylindrical-shaped ones 3 mm. in length by 0·5 mm. in breadth. The necrotic foci lay in soft vascular fibrous tissue. The majority of these masses on being broken up on a slide showed no parasites within the subcutaneous areas, but on teasing out these areas in saline under the microscope it was found that some of them did contain parasites. The parasites lay in canals within the areas and were usually slightly curved or twisted; usually not more than one parasite was found in each necrotic mass. In the second case mentioned above no recognisable nematode parasites were discoverable while in the third case no microscopic examination was possible. The shoulder lesion in the fourth case also presented small necrotic areas on section. Histological examination of the earliest lesions showed that the parasites occurred primarily in the lymph spaces where they gave rise to a small-celled infiltration of the surrounding tissue, an aggregation of neutrophile leucocytes and eosinophiles, and later necrosis. While necrosis is in progress large fibrous tissue cells together with giant cells are found at the periphery of the mass; the tissue between the areas is composed of typical granulation tissue, with eosinophiles and proliferation of endothelial cells and fibroblasts.

A few specimens of partially decomposed parasites were obtained from the lesions. Two of these measured 2·25 mm. and 1·3 cm., respectively, in length by 50μ in breadth. In one of these specimens a spinous tip to the tail could be clearly seen. According to RAILLIET this appearance of the tail is diagnostic of the super-family Spiruroidea and it therefore seems most probable that the parasite belongs to the genus Habronema, the adults of which occur in the stomach of the horse.

The authors then further discuss the etiology of the disease and deal with the probability of its being set up by one or other species of Habronema parasitic in the stomach of the horse and, in the case of one species, known to undergo development in the body of the common house fly (RANSOM). Some pre-existing catarrhal condition of the conjunctiva or individual susceptibility may pave the way for infection. The seasonal occurrence of the disease is held to support the view that it is insect transmitted. "Enquiry into the experience of practitioners goes to show that the milder condition is probably common, with symptoms of persistent slight lachrymation without apparent cause, these small bodies being easily overlooked in a casual examination of the eye."

According to the authors the above condition is not to be confused with the early stages of epithelioma of the eye, a lesion of common occurrence.

VAN SACEGHEM (R.). **Cause étiologique et traitement de la dermite granuleuse.** [The Etiology and Treatment of Granular Dermatitis.] —*Bull. Soc. Path. Exot.* 1918. July. Vol. 11. No. 7. pp. 575–578.

Observations already published by the above author on equine granular dermatitis strongly incriminated flies as the vectors of the Habronema larvae which are the causal agents of so-called summer sores [see this *Bulletin*, Vol. 5, No. 4, p. 248]. Further experiments performed by him are stated to confirm absolutely this view and moreover prove that the parasite found in the verminous nodules is an aberrant larva of *H. muscae.* The view formulated by RAILLIET and HENRY [see this *Bulletin*, Vol. 4, No. 3, p. 102] is thus substantiated.

Larvae of the common house fly, *Musca domestica,* bred in the laboratory beyond reach of possible accidental infection were deposited on a freshly deposited mass of dung from a horse known to be infested with *H. muscae.* The flies emanating from these maggots were found to be infested with *H. muscae* in a proportion of 70 per cent. The larvae were numerous in the proboscis and in the body. It was found that the fly could only become infected during its larval stage; the nymph did not become invaded.

Spiroptera larvae die rapidly in fermenting manure owing to the high degree of heat generated, and this furnishes a means for the destruction of verminous larvae. The Habronema larvae isolated from the flies can survive for longer than 12 hours when placed in a liquid medium. When transferred on to the hair or shaved skin of the horse they die off rapidly and never show the slightest tendency to pierce the skin. On the other hand when deposited on wounded surfaces covered with serous fluid they execute movements and show a marked tendency to become lodged in small crevices.

Horses affected with granular dermatitis often showed conjunctivitis and this was found to be set up by the presence of small verminous nodules located especially on the membrana nictitans. These nodules had the same appearance and disclosed the same parasite as that found in the summer sores.

Habronema larvae withdrawn from the flies were deposited in the inner canthus of the right eye of a horse isolated within an enclosure surrounded by fine mosquito netting. This horse subsequently became affected with conjunctivitis and verminous nodules were found on the membrana nictitans of the right eye. The left eye, which served as a control, did not develop any lesions whereas in the case of the right eye the eyelids became thickened, the conjunctival mucous membrane inflamed, and the membrana nictitans scattered over with small verminous nodules that could be easily enucleated. The infection also set up intense pruritus in the right eye, causing the animal to rub itself continuously.

In another experiment the author made two wounds in the skin of a horse: one of these was protected by netting against flies and the other left uncovered. The horse was placed in a stable in which 20 per cent. of the flies were infected with Habronema larvae. The unprotected wound became the seat of a very intense irritation which caused the horse to bite itself until blood appeared. The wound became transformed into a characteristic summer sore.

The author formulates certain lines of treatment for summer sores based upon knowledge obtained with regard to the habits and life history of the causal organism. Preventive treatment consists in the destruction of *H. muscae* which is found in the stomach of equidae, sometimes in enormous numbers. As a result of numerous post-mortem examinations made by the author upon horses that had succumbed to horse sickness at the Zambi Station, Lower Belgian Congo, where summer sores are very common, it was found that the majority of horses harboured *H. muscae* in their stomachs. Arsenic given periodically in doses of 1–2 grammes per day is considered to be a good remedy against the adult form of *H. muscae.* The destruction of the larval form can be brought about by discarding the use of so-called permanent bedding and taking the precaution to bury fresh dung daily inside a heap of fermenting manure according to the so-called biothermic method formulated by ROUBAUD. Under the action of the heat generated by the dung the Spiroptera larvae as well as the maggots of the flies that may become infested by these larvae are killed off. Wounds on horses should be protected during the dry season against flies by sprinkling over them some astringent powder.

A method of curative treatment regarded as specific by the author consists in careful disinfection of the sore and then in the application of the following powder:—Plaster of Paris 100, alum 20, naphthaline 10, quinine 10 parts, or a sufficient quantity of any other bitter powder. This powder has the property of effectively protecting the sore against flies, being very adhesive, rapidly drying up the sore, and preventing the animal from biting itself owing to the action of the bitter powder contained in it. The powder is said to inhibit further infestation with larvae with certainty and those already present become encysted and are eliminated without causing any damage. All the sores treated in this way became rapidly cicatrised, care being taken to renew the plaster as long as the slightest breach in continuity of the surface remained.

CHATTON (Edouard). **Microfilaire du chat domestique dans le sud-tunisien.** [Microfilaria of the Domesticated Cat in Southern Tunis.]—*Bull. Soc. Path. Exot.* 1918. July. Vol. 11. No. 7. pp. 571–573. With 1 text-fig.

Microfilariae in the blood of the domesticated cat have apparently only been hitherto reported by MATHIS (1909), who based his report on observations made by GAUDUCHEAU on cats in French Indo-China. The organism described by Chatton was found in 2 out of 26 cats examined; one of these cats came from Médine and the other from Gabès. The microfilaria was observed in the heart blood on post-mortem examination of the animals and was very scanty in the case of the first animal and not by any means numerous in the case of the second (1 in every 30 fields of 400μ in a thick drop of fresh blood). The adult was not discoverable but a thorough search was not undertaken. In the case of the other cats the heart blood was examined in some on post-mortem examination and in others blood from the ear was examined during the day and at night. It was thus not possible to find out whether the organism exhibited a daily periodicity in the peripheral blood.

The morphological characters were briefly as follows:—No sheath, body blunted at its anterior extremity and tapering to a fine point at its posterior extremity. Length very variable even in the same preparation (after fixation with osmic acid vapour)—from 240 to 350μ in length and the breadth seemed to vary inversely to the length, i.e., from 9 to 7μ. This might be due to the varying degree of contraction of the parasite. Moreover, the nuclei appeared to be more closely packed together in the shorter organisms. No cuticular striation. There were four constant clear spots (after staining with Giemsa) viz., (1) a sub-terminal cephalic spot often divided lengthwise in two by a nucleated tract; (2) an obliquely situated linear subtransverse spot 60μ from the anterior extremity in a parasite 320μ long; (3) a laterally situated triangular or V shaped spot 85μ from the anterior extremity in a parasite of the same length; (4) a caudal spot also laterally situated, 50μ from the posterior extremity.

The small worm which often becomes twisted on itself by means of regular curves as in the case of the human nocturnal microfilaria (*F. bancrofti*) has, however, the somewhat crumpled aspect of the diurnal microfilaria (*F. loa*). The few data given with regard to the above parasite does not enable one to differentiate between it and the dog filaria (*F. immitis*), which has been recognised in Tunis by LANGERON.

EPIZOOTIC LYMPHANGITIS.

NÈGRE (L.) & BOQUET (A.). **Culture en série et évolution chez le cheval du parasite de la lymphangite épizootique.** [Cultivation in Series and Development in the Horse of the Parasite of Epizootic Lymphangitis.]—*Ann. Inst. Pasteur.* 1918. May. Vol. 32. No. 5. pp. 215–241. With 3 text-figs.

In this paper the authors recapitulate and furnish additional details regarding their researches on the cultivation of the parasite of epizootic lymphangitis [see this *Bulletin*, 1914, Vol. 2, p. 152; 1915, Vol. 3, pp. 71 & 111; 1917, Vol. 5, p. 116; & 1918, Vol. 6, p. 107].

The results obtained by the authors up to the present in their attempts to cultivate the parasite are very briefly summarised as follows :—

Pus containing cryptococci withdrawn aseptically from an unopened abscess and sown on the surface of a medium consisting of agar made up with an infusion of horse dung and then covered with a layer of pulp from the lymph glands also from the horse gives rise to macroscopic colonies which can be transplanted on to media composed of the same material or on to Sabouraud's agar ; lymph gland pulp is added in the first few series but then its addition becomes no longer necessary.

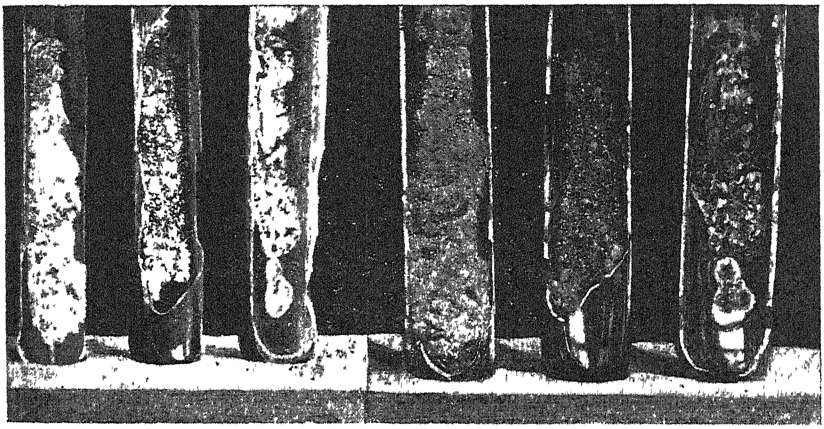

FIG. 1.*

1. Culture on Sabouraud's agar at 37° C.
2. Culture on horse dung agar at 22° C.
3. Culture on Sabouraud's agar at 22° C.

The 1st group viewed from a slightly inclined direction, the 2nd group viewed directly in front.

The parasite assumes the undoubted characteristics of a fungus on the culture media and with continued sub-cultivation the growth is more easily obtained and is more rapid. After a few passages it can be transplanted on to various kinds of agar media, gelatin, potato, and carrot.

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* Figs. 1, 2 & 3 reproduced by permission from the *Annales de l'Institut Pasteur.*

The optimum temperature for the sub-cultures is said to be 37° C. On account of the slow development of the primary cultures this temperature brings about rather too rapid desiccation of the media and a temperature of 25–30° C. is more suitable. At a temperature of 37° C. the colonies on Sabouraud's agar are of a sandy yellow colour and are wrinkled or folded and scattered over with minute areas of a fluffy nature. At lower temperatures the colonies assume a much more marked fluffy appearance. In primary culture the cryptococcus swells up, assumes a rounded appearance, and becomes filled with oily droplets. It then buds giving rise to double-walled mycelial tubes on which are developed the so-called external spores. In subsequent sub-cultures the young colonies are formed of divided or partitioned thin-walled mycelial tubes. In older colonies these filaments disappear after having given rise by budding to the external spores. The latter give rise to double-walled divided mycelial tubes carrying external spores and chlamydospores; they are identical in appearance with the elements which arise from the budding of the rounded forms of the cryptococcus.

The rounded form assumed by the cryptococcus in primary cultures and the external spore thus constitute the origin of the same kind of mycelial formations, which cannot be differentiated by any morphological character. It thus appears that the cryptococcus is the multiplicative form in the animal body of the external spore.

It was found that the cryptococcus could develop in the epidermis of the horse in the shape of mycelial formations identical in appearance with those mentioned above, viz., double-contoured tubes and external spores. It appeared from one observation only, made by the authors and which requires confirmation, that the cryptococcus originates in the epidermis of the horse by budding from the external spore. At the time of budding it only has a thin wall.

In old cultures all the elements forming the mycelial tubes become dislocated and take on a very irregular appearance.

Cultures of the fungus inoculated into the horse by scarification of the epidermis or into the dermis gave rise to buds and abscesses containing cryptococci. After subcutaneous inoculation they set up abscesses containing cryptococci and later these lesions may become generalised with the formation of corded lymphatics and the clinical picture of the natural disease is reproduced.

The cryptococci appear in the lesions in from three to four weeks after inoculation. They are at first free appearing in the form of small thin-walled ovoid elements, later they become double-contoured and then are found for the most part within the leucocytes.

The serum of animals suffering from the disease gives a positive reaction in the fixation of the complement test with the above cultures of the fungus as antigen. Antibodies may be revealed in the blood towards the 20th day after the first appearance of the disease, and they remain for a long time after recovery. After recovery from one attack of epizootic lymphangitis a horse remains refractory to subsequent inoculation with cultures.

It is considered that the fungus cannot be properly classified until

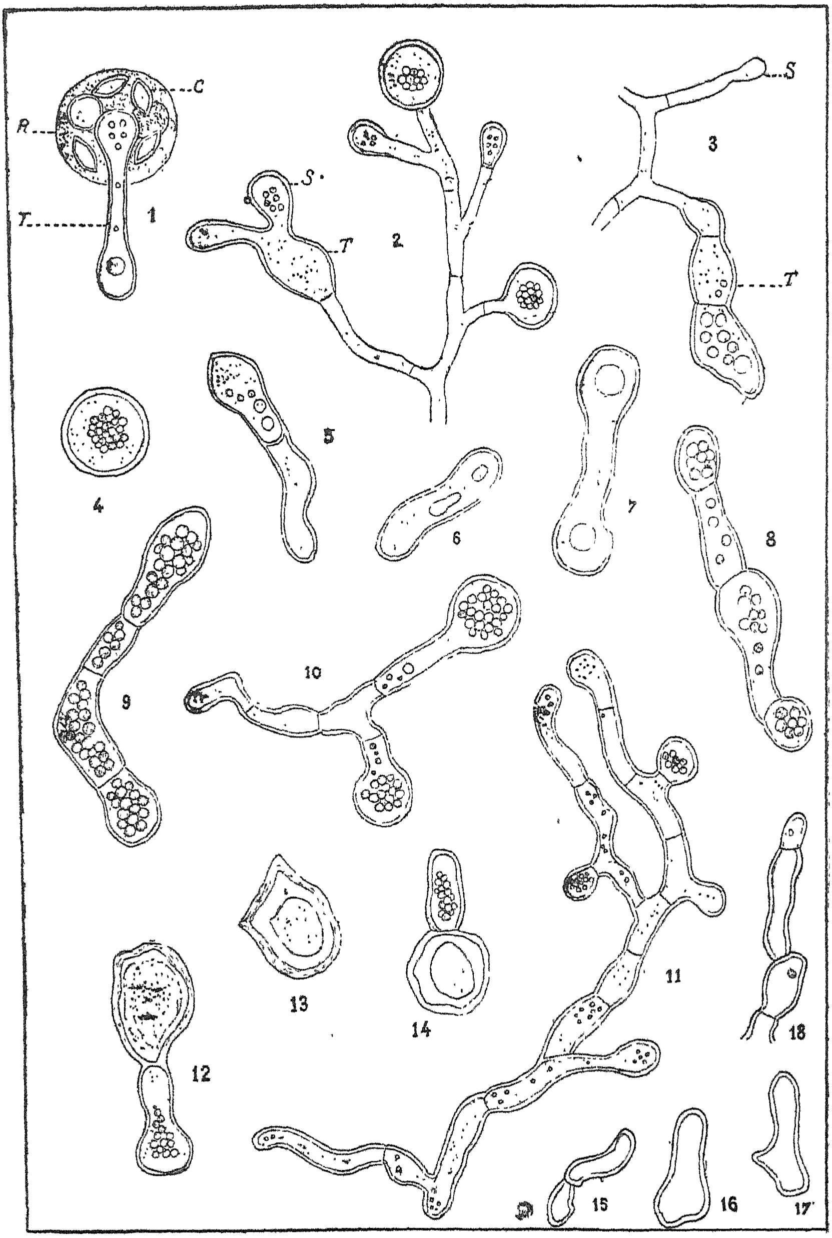

FIG. 2.

1. C, cryptococci within a leucocyte; R, rounded form of the cryptococcus; T, double-contoured mycelial tube arising by budding from a rounded form from a cryptococcus still included within the leucocyte.

2. Thin-walled mycelial tubes in a young colony, giving rise by budding to external spores in different stages of development and to a double-contoured mycelial tube (S), (T) itself carrying a mycelial tube.

3. Thin-walled mycelial tube in a young colony giving rise to a double-contoured tube (T) and first stage of budding of an external spore at the extremity of another branch (S).

4. Free-lying external spore containing droplets of oil.

5, 6, 7, 8, 9, & 10. Double-contoured mycelial formations produced by budding of external spores.

11. Double-contoured mycelial tubes reproducing external spores by budding.

12. Free-lying chlamydospore.

13 and 14. Chlamydospore on mycelial formations.

15, 16, 17 and 18. Disintegrated and distorted mycelial elements in old cultures.

With regard to the authors' experiments on the transmission of the disease by means of cultures it is considered worth while reproducing their data concerning the results obtained by subcutaneous inoculation of the two horses used in their experiments.

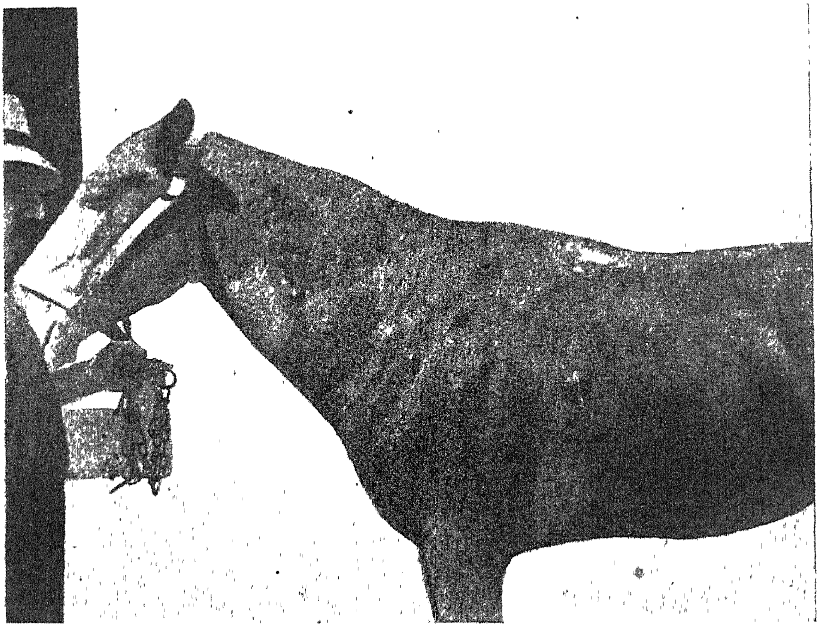

FIG. 3.

Reproduction of epizootic lymphangitis experimentally in the horse. Two beaded corded lymphatics on the neck. On the shoulder lesions produced by smearing cultures on the scarified skin.

(1) One third c.c. of an emulsion of the growth obtained from a first sub-culture sown out three months previously and containing sparing cryptococci that had not budded was inoculated subcutaneously on the left side of the neck. For the first three days after the injection a large very painful oedematous swelling developed. This gradually diminished in size and towards the 25th day took the form of a nodule about the size of a pea. This nodule remained very sensitive to pressure and appeared to have become adherent to the underlying tissues. On the 31st day a fragment of this nodule formed

of firm fibrous connective tissue was excised and in the serous fluid obtained from it small elements about the size of cryptococci, some of which were without a double-contour and others with a characteristic double-contour, were seen under the microscope. Towards the 50th day the lesion assumed a secondary phase characterised by increase in size of the nodule which reached the dimensions of a large walnut and by the appearance of oedematous swellings, viz., a swelling surrounding the lesion and swellings some distance away on the level of the throat and towards the front of the shoulder. On the 60th day these oedematous swellings disappeared, the nodule increased in size, fluctuated and burst, discharging pus containing cryptococci. A small firm corded swelling appeared as an outgrowth from the nodule; this small cord disappeared at the end of two days and then reappeared on the 70th day. On this date two oblique corded lymphatics were seen to emanate from the suppurating bud and become directed towards the jugular furrow. The lower cord was about the thickness of a large pencil and presented along its course a number of buds each about the size of a sixpence. The upper cord was smaller in size. At their lower ends these cords ran closer together. They reached in length about two thirds the length of the neck. The lower cord presented 11 closed buds, the upper cord 7. On the 73rd day the upper cord disappeared and its remains were indicated only by two small buds. Only a single beaded lymphatic thus remained. At the end of 4½ months the buds suppurated. Recovery took place in 7 months.

(2) The horse experimented upon was inoculated with an 8th subculture from a strain isolated 11 months previously. One and a half c.c. of an emulsion of a three weeks' old culture was inoculated underneath the skin at the level of the right and left shoulders. A large widespread very painful oedematous swelling developed during the first 4 days after the inoculation. On the 5th day the oedematous swelling disappeared leaving firm nodules about the size of an almond. The nodules diminished in size up to the end of the third week. They then began to increase in size and at the end of four weeks each was about as big as a large hen's egg. A few days afterwards firm filiform cords appeared starting from the nodules and descended round in front of the fore arm down to about its middle. After about two months the nodule on the left shoulder began to suppurate and its contents gradually became discharged. The nodule on the right remained much longer in the form of a large indurated mass which finally became softened and discharged a pus containing cryptococci.

[These experiments on the transmission of the disease by rich cultures are not altogether convincing inasmuch as the disease set up was mild in character compared with that observed in most cases of the natural disease and apparently disappeared spontaneously. Also, it might occur to one that in the first experiment especially the lesions could perhaps have been set up by minute quantities of the original cryptococci which had remained unchanged on the media after sowing out from the pus. The organisms are well known to retain their vitality for a considerable time.—Ed.]

BOQUET (A.), NÈGRE (L.) & ROIG (G.). i. **Premiers essais de vaccination préventive contre la lymphangite épizootique.** [Experiments in Preventive Vaccination against Epizootic Lymphangitis.]—*Bull. Soc. Path. Exot.* 1918. July. Vol. 11. No. 7. pp. 551-553.

——, —— & ——. ii. **Mycothérapie de la lymphangite épizootique.** [Mycotherapy of Epizootic Lymphangitis.]—*Ibid.* pp. 609-616.

Hitherto, owing to the fact that artificial cultures of the organism of epizootic lymphangitis have not been obtainable, the treatment of this disease has only been undertaken with chemical agents, e.g., potassium iodide (TEPPAZ), arsenobenzol (BRIDRÉ, NÈGRE & TROUETTE), with the pus containing the cryptococcus from affected animals (BELIN, VELU), or with biological products, e.g., yeast extract (M. NICOLLE, FAYET & TRUCHE). Recently BRIDRÉ [see this *Bulletin*, 1918, Vol. 6, No. 1, p. 17] has shown that good results may be obtained by the use of aseptic pus and these cast doubt on the action of the cryptococcus in the treatment devised by BELIN and by VELU.

The material used by the authors for vaccination was prepared as follows :—

The colonies of cryptococci about two months old are lifted from the Sabouraud's agar medium by means of a spatula, crushed up finely in a mortar and then emulsified in normal saline solution in the proportion of 1 tube of culture to 30 c.c. of liquid. About 20 centigrammes of dry culture are obtainable from a medium sized test tube. The superficial parts of the colonies only are utilised, the deeper parts remaining adherent to the agar. This emulsion is distributed in ampoules which are sealed and heated for 1 hour at 62° to 64° C. Heating at this temperature is sufficient to eliminate the pathogenicity of the fungus. The vaccine is injected subcutaneously in the region of the neck commencing with a dose of 2 c.c. and increasing this dose by 1 c.c. with each successive injection but in no case exceeding 5 c.c. The injections are performed at weekly intervals. The horses injected did not receive any other treatment or any surgical operation and the abscesses were left untouched. Fourteen horses were treated by means of these heated cultures. The results in four of these cases could not be followed up on account of difficulties in keeping them under observation, but the data obtainable from the treatment of these four preliminary cases enabled the authors to fix upon a suitable method for administering the vaccine. These cases are described very briefly in the first paper. In the case of the remaining 10 horses affected with more or less long standing and severe forms of the disease the authors report at greater length upon their progress under treatment. They divide these cases into two categories, viz., (1) those with cutaneous lesions, buds and abscesses but without apparent corded lymphatics, and (2) those with corded lymphatics. Two of these animals died from secondary infections in the course of the treatment. The other 8 animals recovered after intervals of from 1 to 3½ months from the commencement of the treatment and none of these animals suffered from a relapse.

With regard to the effects of the inoculations upon the treated animal one finds a fairly large, very painful, tender swelling about the size of the palm of the hand at the seat of injection for 24 hours after the inoculation. The temperature rises about 1° C. on the following day and remains above normal for 2 or 3 days. The swelling becomes absorbed in 3 or 4 days but the seat of injection remains painful for several days afterwards. After the 3rd and sometimes the 4th injection there forms at the seat of inoculation an abscess which may become absorbed or open and discharge a sterile pus. After each of the first injections the lesions of the disease become distinctly exacerbated; the buds and abscesses suppurate more freely and this stage may cover 5 or 6 days. It corresponds, as VELU has shown, to a negative phase and may appear to last so long as the product injected has not been completely absorbed. If the vaccine is injected again during this first phase bad results are always obtained, and successive injections given at less than 6 or 7 days interval cause the disease to assume a very acute form. After the 3rd or 4th injections the continued treatment does not appear to exercise much apparent effect upon the disease. All the lesions continue to suppurate and one might be led to abandon the treatment as inefficacious, but suddenly the course of the disease changes, the lesions become dried up and then cicatrise rapidly, the swelling around the corded lymphatics disappear and the corded lymphatics themselves gradually diminish in size, the deeply situated glands regain their normal size, and recovery then takes place. Recovery is most rapid in the case of lesions which suppurate most readily; it is much slower in the case of the corded lymphatics and in the case of these lesions surgical intervention, as VELU has shown, would undoubtedly hasten recovery. In the former cases recovery was obtained in from 1 to 2 months, i.e., after 4 to 8 injections, but in the cases with corded lymphatics recovery took from 3 to 3½ months, i.e., after about 9 injections.

CARPANO (Matteo). **Le associazioni batteriche nelle infezioni da** *Cryptococcus farciminosus* **(Rivolta 1873).** [Bacteria associated with the Cryptococci in Epizootic Lymphangitis.]—*Ann. d'Igiene.* 1918. June 30. Vol. 28. No. 6. pp. 273–279.

In a small outbreak of epizootic lymphangitis occurring in the district around Rome the following results were obtained on examination of pus obtained from the lesions:—Cryptococci alone 5 cases, cryptococci mixed with *Staphylococcus aureus* and *albus* 6 cases, with a non-specific pyogenic organism 1 case, and with *Staphylococcus pyogenes*, a streptococcus, *B. subtilis*, *Proteus vulgaris*, and various species of Hyphomycetes, 1 case.

A further examination of material obtained from early and closed deep-seated lesions taken so as to avoid risk of outside contamination was made. Out of 41 cases found to contain cryptococci on microscopic examination these organisms were found associated with streptococci and staphylococci in 15 cases, with streptococci alone in 10 cases, and with staphylococci alone in 2 cases.

A bacteriological study of the associated micro-organisms was made. The streptococci were found to be indistinguishable from that of strangles, while the staphylococci represented nearly all varieties of *Staphylococcus pyogenes*.

BACTERIAL DISEASE.

MASON (F. E.). **Tuberculosis in the Camel.**—*Jl. Comp. Path. & Therap.* 1918. June. Vol. 31. Pt. 2. pp. 100–102.

The author has dealt with the above subject in a previous communication [see this *Bulletin,* 1917, Vol. 5, No. 2, pp. 117–118]. In the present article he places on record what is believed to be the first authentic case of congenital tuberculosis in the camel. The tuberculous lesions were found in the liver of an eight months old foetus; this organ contained numerous nodules varying in size from a pea to a haricot bean and its lymphatic glands were enlarged to the size of a walnut and caseous. No other lesions were found in the body. Numerous acid-fast bacilli were found in the lesions and after cultural examination and guinea-pig inoculation these were concluded to be of the bovine type.

The dam of this foetus was tested with ordinary tuberculin (4 c.c. subcutaneously) and a distinct temperature reaction was obtained. The animal was then slaughtered and advanced lesions of tuberculosis were found in the visceral organs.

In former articles the author has drawn attention to the small number of cases of tuberculosis recorded in camels outside Egypt. The number of recorded cases does not appear to exceed four. The author now records an old-standing case of pulmonary tuberculosis in a recently imported Algerian camel. The nature of the lesions indicated that this animal had undoubtedly become infected prior to the date of importation.

DISEASES DUE TO FILTERABLE VIRUSES.

REMLINGER (P.). i. **Diffusion du virus rabique dans la glycérine.** [Diffusion of Rabies Virus in Glycerine.]—*C. R. Soc. Biol.* 1918. Jan. 12. Vol. 81. No. 1. pp. 20–21.

——. ii. **Passage "in vitro" du virus rabique dans des cerveaux et dans des organes.** [The Diffusion *in vitro* of Rabies Virus in Brains and Organs.]—*Ibid.* Jan. 26. No. 2. pp. 55–57.

——. iii. **Sur un lapin naturellement réfractaire à la rage.** [A Rabbit Naturally Resistent to Rabies.]—*Ibid.* Feb. 23. No. 4. pp. 162–164.

——. iv. **Imperméabilité du tube digestif des animaux jeunes au virus rabique.** [Impermeability of the Digestive Tracts of Young Animals to the Rabies Virus.]—*Ibid.* Mar. 23. No. 6. pp. 277–278.

——. v. **La rage conceptionnelle est-elle possible?** [Is it Possible to Contract Rabies at the Time of Conception ?]—*Ibid.* Apr. 27. No. 8. pp. 418–419.

——. vi. **Le virus rabique se généralise-t-il** *post mortem*? [Does the Rabies Virus become Generalised Post-mortem ?]—*Ibid.* June 8. No. 11. pp. 564–566.

i. Although the preservative properties of glycerine with regard attention appears to have been paid to the question as to whether the virus passes into the glycerine itself. A number of brains of animals that had succumbed to rabies were immersed at various temperatures (0° C., 12–15° C., 37° C.) in glycerine kept in a vessel in the dark. In from 6–10 days the glycerine was filtered through muslin or filter paper and injected intramuscularly into guinea-pigs and rabbits. Six out of 13 animals were subsequently definitely proved to have succumbed to rabies. The infectivity of the glycerine in these cases would appear to be due to a diffusion of the virus and as there could be no question of its growth the virus thus differs considerably from a number of visible micro-organisms such as the anthrax bacillus and the tubercle bacillus, which show no tendency to spread from organs such as spleen into the surrounding glycerine.

ii. A number of brains of rabbits or guinea-pigs dead of rabies were washed in normal saline solution and immersed in a vessel containing about 50 c.c. of sterile glycerine. The brain of a healthy rabbit was suspended in this liquid and the whole kept in the dark at room temperature. Pieces of the healthy brain taken at intervals from the 4th to the 12th day were found to induce rabies in about one third of the animals subsequently inoculated.

Positive results were likewise obtained when the brains of animals immune to rabies such as the fowl or land turtle were suspended in the glycerine. Similarly when the liver or kidney was used instead of the brain positive results were obtained in a certain number of cases. The author concludes from these results indicating the diffusibility of the virus that the Negri bodies of rabid brains are in all probability devoid of pathogenic action: they are very likely products formed in the defence of the body against the causal organism or toxin.

iii. Inoculation of rabies virus sub-durally into the rabbit constitutes one of the most severe tests to which a laboratory animal can be subjected. With precise regularity the animal shows the first symptoms on the 6th or 7th day and succumbs from 3 to 5 days later. Out of several thousand inoculations thus performed by the author at Constantinople one rabbit only was found resistent. The operation was repeated three times on this rabbit without success. VIALA observed one similar case in 1909 at the Pasteur Institute, Paris, where several thousand such inoculations have been performed. In this paper the author places on record the case of a rabbit which showed exactly the same history as the above at Tangier. The natural immunity in the case of these rabbits is of somewhat extraordinary interest inasmuch as it is found extremely difficult to confer protection against "street" rabies on the healthy rabbit in the laboratory.

iv. Ten adult guinea-pigs were fed with emulsion of brain substance taken from animals that had succumbed to rabies: three subsequently died from rabies. One of the symptoms was marked sniffing and thus it was suspected that infection might have taken place via the nostrils. In a second series of experiments 30 young guinea-pigs less than 25 hours old received a thick emulsion in milk of fixed virus that had been adapted by numerous passages to the body of the guinea-pig; great care was taken to avoid contamination of the nasal mucous membrane. The result was absolutely negative. Twenty young rabbits from 8 to 12 days old were made to ingest an emulsion of fixed virus in a similar manner. No deaths occurred.

The mucous membrane of the digestive tract of the rabbit and guinea-pig thus appears to offer a powerful resistance to penetration by the rabies virus inasmuch as young guinea-pigs even a few hours old could not be infected. This resistance is very remarkable inasmuch as closely related rodents, namely the Muridae, can be infected very easily, even as adults, by way of their digestive tract.

v. KONRADI and others have recently proved beyond doubt the hereditary transmission of rabies in certain cases and the question arises whether the virus can be transmitted at the time of conception. In order to elucidate this question the author performed the following experiments on the guinea-pig, in which animal genital excitability is as a rule most marked, especially when infected with "street" virus. Transmission at conception would require the presence of the virus in the spermatozoon or in the ovum and thus the experiments were carried out with the contents of the seminal vesicles of the testicles and the ovaries of rabid guinea-pigs. All the experiments were carried out with "street" virus maintained by transmission through a series of guinea-pigs.

The contents of the seminal vesicles of 15 guinea-pigs that had died from rabies were emulsified in normal saline solution and in each case inoculated under the dura mater of a rabbit and of a guinea-pig. In addition the inoculated guinea-pig was injected into the muscles of the neck with the whole of the emulsion that had not been used up in the sub-dural injections. None of the inoculated animals developed rabies.

The testicles of 6 rabid guinea-pigs were macerated and the whole of the emulsion inoculated under the dura mater and into the neck muscles of 12 guinea-pigs. None of these developed rabies.

The ovaries of 6 guinea-pigs that had died after inoculation with "street" virus were carefully triturated in salt solution and inoculated sub-durally and into the neck muscles of 6 rabbits. None of these developed rabies.

Finally, the bodies of 48 guinea-pigs that had died of rabies were kept for from 24 to 48 hours at laboratory temperature before the ovaries (24 guinea-pigs), the testicles (12 guinea-pigs), and the contents of the seminal vesicles (12 guinea-pigs) were excised and used for inoculation. These were inoculated exclusively into the neck muscles of the rabbit or guinea-pig, in order to eliminate the setting up of meningitis due to the inoculation of post-mortem invaders. In order to make up for the decreased amount of severity following this method of inoculation the author inoculated double the quantities used in the preceding experiments into each animal. None of the animals inoculated (12 rabbits, 24 guinea-pigs) developed rabies.

The absence of the virus in the semen has already been demonstrated by various authors. BLASI and Russo TRAVALI are the only workers who claim positive results. No work appears to have been hitherto performed on the ovary. All the animals inoculated by Remlinger were kept under observation for 16 months subsequent to inoculation. He thus concludes that rabies is not transmitted that all cases of hereditary rabies are connected with placental infection.

vi. The author recalls the results of the last-described experiment in which the ovaries, testicles and seminal fluid of guinea-pigs were used for inoculation in from 24 to 48 hours after death: from these he concludes that the onset of putrefaction does not bring about the presence of the rabies virus in an organ where it is not found during life or during the first few hours after death.

The question next arises whether the virus may gain access after death into an organ in which it is not constantly present during life. The spleens of 12 guinea-pigs killed a few hours before natural death were emulsified and in the case of the emulsion from each spleen as much as possible was inoculated sub-durally and the remainder into the neck muscles of a healthy guinea-pig. Three of the inoculated guinea-pigs developed rabies while 9 remained healthy. Twelve other guinea-pigs were inoculated similarly with spleens taken in from 1 to 12 hours after natural death; 3 out of 12 likewise of the inoculated animals developed rabies. In a third series of experiments 12 guinea-pigs dead of "street" rabies were left from 24 to 48 hours at laboratory temperature and emulsions of their spleens then inoculated into the neck muscles of healthy guinea-pigs; 1 animal only developed rabies.

Inasmuch as the greater number of negative results in the last experiments might be due to the diminished severity in the method of inoculation the author inoculated into the neck muscles of each guinea-pig from 2 to 3 spleens in order to counterbalance this factor. Also in this series of experiments the carcases were left unopened for from 2 to 3 days. Out of 6 guinea-pigs inoculated 1 only developed rabies. It would thus appear that instead of favouring the multiplication or diffusion of the virus the onset of putrefaction caused it to be less readily discoverable. This fact, however, is most probably due to the lessened chances of infection on account of the method employed of inoculating intramuscularly.

In a final series of experiments this cause of error was eliminated. The suprarenal capsules of 16 rabid guinea-pigs killed just before death were macerated, emulsified, and inoculated into the neck muscles of 16 guinea-pigs; 7 (44 per cent.) developed rabies; the others survived. Another series of 16 guinea-pigs was similarly inoculated with the suprarenal capsules of 16 guinea-pigs dead of rabies and kept for from 24 to 48 hours at laboratory temperature before post-mortem examination was performed; 11 (68 per cent.) developed rabies, the others survived.

It appears from the above data that post-mortem generalisation of rabies is rare and inconstant. Moreover, the experiments that have hitherto been performed in order to ascertain the distribution of the virus in various organs are not apparently vitiated with serious error on account of the fact that account had not been taken of the possibility of generalisation.

The virus appeared to become less readily diffused in the animal body than it does *in vitro* in normal saline solution, Locke's fluid, glycerine, and other liquids.

LANFRANCHI (A.) & LENZI (F.). **Sur le passage du virus rabique de la mère au foetus.** [Passage of the Rabies Virus from Mother to Foetus.]—*C. R. Soc. Biol.* 1918. Apr. 27. Vol. 81. No. 8. pp. 396–398.

A pure bred wolfhound bitch, 10 months old, was brought under the authors' observation suffering from dumb rabies. This animal possessed a history of having been in contact with a dog suffering from rabies and though it showed no obvious signs of having been bitten it was quarantined for 6 months. It was then returned to its owner, and lined by a great dane. The bitch died the day after it had been brought to the author's clinic and seven full-grown foetuses were withdrawn post-mortem. Examination as to the presence of Negri bodies in the hippocampus gave positive results in the case of the mother but negative in the case of the foetuses.

The spinal cords of the bitch and the seven pups were withdrawn with sterile precautions and inoculated into rabbits either sub-durally, into the anterior chamber of the eye, or intramuscularly. All the rabbits inoculated succumbed with characteristic symptoms of rabies on the 12th day. The rabbits were submitted to careful clinical observation in order to make certain that they were really suffering from a rabies infection. The rise in temperature shown to occur by BABES at the commencement of the disease was looked for in particular and also the loss in weight to be noted in rabbits dead of the infection was established up to a third series of passages.

In the above case there is thus no doubt that the rabies virus traversed the placental filter and reached the nervous system of the foetuses from the mother.

Contrary to the statements of LOIR and KONRADI no attenuation of the virus was noticed after it had passed through the placental filter; there appeared to be no differences especially with regard to the duration of the disease and its clinical course. According to KONRADI the period of incubation in guinea-pigs inoculated sub-durally with brain material from foetuses may be extremely long, even up to 725 days in one of his cases. It is thus probable that the negative results claimed by some authors, such as REPETTO, were due to the fact that the experimental animals were not kept long enough under observation.

KOYANO (Tadayasu). **Beiträge zu den experimentellen Studien über die Lokalisation des Wutvirus.** [Experimental Studies on the Distribution of Rabies Virus.]—*Mitteil. a. d. Med. Fak. d. Kais. Univ. zu Tokyo.* 1917. July 9. Vol. 18. No. 1. pp. 91–101.

Although the virus of rabies resides principally in the central nervous system recent work of authors shows that it varies greatly in quantity in different parts of the brain and spinal cord and the nerve trunks; with regard to its presence in the cerebro-spinal fluid and other organs of the body opinions are somewhat sharply divided.

An interesting review of this subject is given by the author. In his own experiments a number of rabbits were injected with "fixed" virus and after their death various parts of the central nervous system and other organs inoculated into healthy rabbits. He concludes sublinqual, and parotid, as well as the haematopoietic organs such as the spleen and lymphatic glands, are not invaded in the case of infection with the "fixed" virus or, at any rate, the presence of virus cannot be demonstrated in them by animal experiment. The secretory organ found inside the skull, that is to say, the anterior lobe of the pituitary body, on the other hand, is certainly virulent. The posterior lobe of this gland was also found to be constantly virulent, whilst the cerebro-spinal fluid on the other hand, taken from the central canal of the spinal cord and from the sub-dural space, was avirulent.

SCHERN (Kurt) & MAVRIDES (Nikolaik). **Ueber Rinderpest. (Erste Mitteilung.) Spontane klinische Heilungen bei Rinderpest.** [Spontaneous Clinical Recovery in Rinderpest.]—*Ztschr. f. Infektionskr. . . . d. Haustiere.* 1918. June 3. Vol. 19. No. 3. pp. 193–196. With 3 charts comprising 50 figs.

In the fourth stomach of apparently healthy cattle killed at an abattoir in Asia Minor MROWKA observed lesions very closely resembling those of rinderpest. The investigations carried out by the authors were made in order to determine whether these were in reality spontaneously healed rinderpest lesions. Their observations were made on so-called virus cattle used in the anti-rinderpest serum institute at Pendik.

The majority of these animals became so severely affected after artificial infection that they were bled for virulent blood when the symptoms were at their height. In many cases, however, the animals manifested after infection only slight symptoms and subsequently became recovered in the clinical sense. It has recently been customary to slaughter all these apparently recovered animals and thus opportunities were afforded for a minute examination of the various organs. During the years 1915–1917 1,734 animals were infected with virus and of these 543, or 31·31 per cent. recovered. These comprised almost exclusively Anatolian cattle, which are much more resistant to rinderpest infection than European breeds. In natural outbreaks it is estimated that from 45–50 per cent. of these native cattle spontaneously recover.

The authors carefully depict on their charts the results concerning 50 of these recovered animals—including date of infection, clinical symptoms, date of slaughter, and post-mortem changes when present. From these results it is noticeable that the great majority of the clinically recovered animals still showed evidence of rinderpest on post-mortem examination. The results in the case of three of these animals may be given briefly in order to demonstrate this.

One animal after subcutaneous infection showed clinical symptoms lasting 4 days. Forty-one days later it showed typical lesions in the fourth stomach consisting in ecchymoses of the mucous membrane of the pyloric region. The second animal manifested clinical symptoms ending 13 days after the artificial infection. On slaughter 88 days later it showed typical lesions in the heart and fourth stomach (very numerous widespread protruding haemorrhages under the endocardium of the left heart; recently healed congested scars on the pyloric mucous membrane; the fourth stomach was used for artificial infection). The third animal showed no apparent clinical symptoms and no rise in temperature after artificial infection. Nevertheless on slaughter 20 days after infection it showed a few congested healing patches on the pyloric mucous membrane.

In cases where the rinderpest infection was complicated by the piroplasmosis due to *P. bigeminum* or *Theileria parva* the process of healing in the lesions involving the mucous membrane of the fourth stomach was considerably retarded. From their results the authors consider that in rinderpest infected countries lesions of the fourth stomach and of the heart particularly are to be looked for as evidence of recovery from rinderpest. In infected animals lesions may be found even in cases that showed no clinical evidence of the disease during life.

ALDIGÉ (E.). **Notice sur la péripneumonie contagieuse des bovidés en Afrique occidentale française.** [Contagious Bovine Pleuro-Pneumonia in French West Africa.]—Imprimerie du Gouvernement général, Gorée. 1917. Abstracted in *Rev. Gén. Méd. Vét.* 1918. Apr. 15—May 15. Vol. 27. Nos. 316–317. pp. 152–153.

"The above disease affects cattle and buffaloes. A few species of wild cattle such as yak and bison are susceptible while all other species of animals are resistent under natural conditions of their life.

"The Peuhls of Guinea term the disease *Dioppé*, meaning lung, and hence, disease of the lung. It seems that pleuro-pneumonia has been in existence for a long period in French West Africa. It persists in an enzootic form in Central Africa and Mauritania, whence from time to time it spreads and produces severe outbreaks in the breeding districts of French West Africa.

"The disease has been recorded since 1912 in Soudan, Dahomey, the Ivory Coast, Guinea, and Senegal; it has appeared in a very severe form and caused considerable losses. In this territory pleuro-pneumonia presents the same clinical and post-mortem appearance as it does elsewhere.

"Different breeds appear to vary in susceptibility. The breeds found along the Dahomey coast 'seem to be refractory to pleuro-pneumonia' (PECAUD). In French West Africa the n'dama breed of Guinea is more sensitive then zebus and cross breeds. The increase in breeding operations in the country and long journeys favour the dissemination of the disease. In the event of great outbreaks centres of infection appear along the traffic routes.

"The author studied the effects of inoculating pleuro-pneumonia lymph into young cattle; the injection of 2 c.c. just behind the shoulder gave varying results from a very extensive oedematous swelling down to no apparent reaction. Older animals seem to react more frequently and exhibit more severe reactions.

"Preventive inoculation has been practised by the Moors for several centuries, and it is of common use among certain peoples and completely unknown among others. The natives usually insert under the skin of the forehead a small piece of lung that has been allowed to macerate for several days in water or buried in earth or sand. Calves are inoculated in the ear, caudal inoculation is not practised. Aldigé recommends the inoculation of lymph diluted in a watery solution of carbolic acid, glycerine and citric acid. The virus is injected into the tail by inoculation into the superficial structures. The subsequent history of the animals and the complications that occur are very much the same as those observed in the case of European cattle. Sometimes, however, swellings develop at a considerable distance from the point of inoculation.

"The author does not believe that the method of stamping out is applicable in combating pleuro-pneumonia in West Africa, inasmuch as the centres of disease are innumerable and the animals are moved about so frequently. The application of any other means likely to produce good results is difficult. 'A rigorous prophylaxis of the infection [he writes] is at the present time impossible in French West Africa.'"

VAN SACEGHEM (René). **La peste du cheval ou horse sickness au Congo belge.** [Horse Sickness in the Belgian Congo.]—*Bull. Soc. Path. Exot.* 1918. May. Vol. 11. No. 5. pp. 423–432.

Horse sickness has only been observed in the Belgian Congo in the Province of Katanga where it has appeared in the form of an epizootic in the stud of the Zambi Agricultural Station, Lower Belgian Congo. In order to confirm the diagnosis the author injected into a healthy horse 2 c.c. of oedematous fluid collected from the intermuscular spaces of a horse that had just died of the disease. Four days after inoculation the horse showed a marked foetid diarrhoea and towards the end of the 5th day the temperature began to rise slowly. On the 6th day distinct symptoms became observable, temperature 40·4° C., conjunctival mucous membrane congested and membrana nictitans covered with large petechiae; lachrymation, upstanding coat, and depression were also noticed, but the appetite was maintained. Also numerous wheezing noises were heard, buccal mucous membrane was congested, tongue thickened, salivation increased, respiration accelerated, pulse 90 and strong. On the 7th day these symptoms remained, temperature 40·7° C. and the pulse became thread-like; appetite remained. On the 8th day the appetite was lost, the temperature fell from 39° to 36·5° C. and the horse died on the morning of the 9th day. It is stated that the lesions usually seen in horse sickness were all discoverable post-mortem.

With regard to the origin of the outbreak among the horses the following somewhat striking observations were made by the author. Horse breeding had been carried on very successfully at Zambi since 1908 and no cases of horse sickness or other serious disease had been observed among the horses. In May 1917 a flock of sheep was imported from Angola and these were allowed to graze for several days in the pastures occupied by the horses and cattle of the station. These sheep were affected with several parasitic diseases and then a large mortality occurred among the flock. The sheep died after having shown fever, and also spasms and stiffness of the limbs were constant symptoms. On post-mortem examination the lungs were covered with large petechiae; the pericardial sac was greatly distended and surrounded at its base with a gelatinous exudate. The pericardial fluid was very abundant (more than 100 c.c.), white and rapidly coagulated. Gelatinous amber-coloured masses were found on the peritoneum and the omentum was covered with an exudate of a gelatinous aspect and consistency. The liver was hypertrophied.

A few weeks after the arrival of these sheep at Zambi horse sickness made its appearance and subsequently caused very serious losses in the stud.

The symptoms and lesions observed in the case of the sheep were identical with those of the disease known as " heartwater " and thus the author was led to believe that " heartwater " and horse sickness might be two diseases possessing a common origin, as previously suggested by EDINGTON and Morton COUTTS. In order to obtain experimental evidence in support of this view the author injected subcutaneously a Java horse born at Zambi with 20 c.c. of pericardial fluid from a sheep showing symptoms of " heartwater " and slaughtered *in extremis.* The horse died 9 days after the injection of the fluid with all the symptoms and lesions of horse sickness. The author thus feels justified in stating that horse sickness was introduced into Zambi by a flock of sheep coming direct from Angola. These sheep were said to have come from a district where "everything died."

The question arises whether the lesions of "heartwater" observed in the Congo in the above sheep were identical with those found in the disease long known to affect cattle, goats, and sheep in South Africa. The author himself was unable to reproduce the disease by inoculating an ox of the Dahomey breed and a Breton heifer with the blood of Angola sheep affected with "heartwater," but, on the other hand, the susceptibility of these breeds for "heartwater," has not been studied. In the case of native sheep, which are naturally resistent towards "heartwater" the injection of blood produced marked febrile reactions. A native goat showed a temperature reaction of 42° C. subsequent to inoculation.

Theiler and Stockman, however, showed that goats vaccinated against horse sickness were still susceptible to "heartwater" infection and thus concluded that the two diseases were not caused by the same virus. Van Saceghem's experiments showed that native sheep exhibited a febrile reaction after having been injected with the virus of horse sickness, and his experiments were thus in concordance with those of Edington.

It has not been shown that the virus of horse sickness can give rise to "heartwater" experimentally.

Theiler showed that the virus of horse sickness could be transmitted by inoculating goats and dogs in series.

Experiments performed by the author at Zambi on the transmission of horse sickness to cattle gave negative results. On the other hand a goat inoculated with defibrinated blood from a horse affected with horse sickness succumbed 15 days after the injection. A sheep inoculated with citrated blood from a lamb dead of the disease causing serious losses among the Angola sheep died a month afterwards; a goat inoculated with defibrinated blood from this sheep died 16 days afterwards with the same symptoms as the goat inoculated with horse sickness blood.

The tick *Amblyomma hebraeum* is recognised as the transmitting agent of "heartwater" in South Africa. This tick does not exist at Zambi but *A. variegatum* and *A. splendidum* are to be found there. Sheep dead of "heartwater" and horses dead of horse sickness were infested especially with *Rhipicephalus appendiculatus* and *R. evertsi* var. *albigeniculatus*. The outbreak of horse sickness in Zambi spread, however, among horses from which ticks had been carefully got rid of, and in a district where there were no ticks. Ticks, however, have been proved to harbour the virus for a very considerable time in their bodies. It has, however, been shown that mosquitoes and other biting flies are capable of transmitting the disease. The author observed that horse sickness propagated especially within a limited area and particularly among horses belonging to the same lot. Police horses traversed the whole region during the course of the outbreak and the only precaution taken was to keep them at a distance from the infected kraals. None of these horses became infected. For this reason the author believes that the principal transmitting agent at Zambi is a small biting fly of the genus *Culicoides* Latr. closely related to *C. neavei* Aust. These never separate themselves from the groups of horses and are difficult to find during the day. They are only seen flying from animal to animal in the very early morning, and often make their way into the conchal cartilage of the ear. During the outbreak there were also to be found numerous flies of the species *Tabanus pluto.*

A few small experiments in the treatment and control of the disease were undertaken.

The following are the author's conclusions :—

(1) "Heartwater" of sheep gave rise to horse sickness in the horse but was not transmissible to cattle.

(2) The virus of horse sickness produces febrile reactions in goats and sheep.

(3) The virus of horse sickness and of "heartwater" should be considered as two varieties of the same virus.

(4) Horse sickness is spread at Zambi especially by biting flies Culicoides and Tabanus.

(5) Horses of the Bayar, Cayor, and Senegal breeds are very resistant towards horse sickness. On the other hand horses of the Ardennes, Java (Sandal Wood), and Russian breeds show little resistance.

(6) Large doses of camphorated oil injected subcutaneously bring about good results in the treatment of horse sickness.

(7) It seems that one can immunise horses by progressive injections of virulent serum mixed with an equal volume of glycerine and allowed to come in contact with $\frac{1}{4}$ of its volume of sulphuric ether for 12 hours.

MISCELLANEOUS.

DODD (Sydney). **Studies in Black Disease. A Braxy-Like Disease of Sheep.**—*Jl. Comp. Path. & Therap.* 1918. Mar. 30. Vol. 31. Pt. 1. pp. 1–35.

This article is of great general interest inasmuch as it throws light on the role of the anaerobic organisms incriminated by various investigators as the cause of braxy-like diseases in sheep in various parts of the world. The disease known as "black disease" studied by Dodd appears to have caused considerable mortality among sheep in the Southern Highlands of New South Wales for the last 50 years. The condition owes its name probably to the fact that the undersurface of the skin assumes a dark colour soon after removal from the body. A condition which is very similar if not identical occurs in Victoria and was investigated by GILRUTH (1910–1911) who assigned as the cause of the disease a bacillus (Gilruth's bacillus). The clinical features and lesions of the disease also resemble those of a braxy-like disease of sheep in Tasmania and of the disease known as braxy or bradsot in Europe.

The so-called black disease is distinctly enzootic in character; a high mortality may occur among sheep kept in certain paddocks whereas in closely adjacent ones no losses occur. The disease usually makes its appearance about February (late summer) and lasts until about May (early winter). Animals may be attacked at any age and those affected are invariably in good condition; sex does not appear to play any part. The mortality varies considerably every year; in some flocks it may rise from 15 to 30 per cent. per annum.

Unless sheep are watched closely all day no symptoms are observed; the animal is simply found dead. If a flock is very carefully watched cases are found to show slight signs of illness prior to death. These do not generally last more than a few hours and a sick animal is found to become separated from the rest of the flock, stagger, and then lie down quietly; the temperature varies from 104° to 107° F.; there is marked injection of the visible mucous membranes, the respirations are shallow and the pulse weak or almost imperceptible.

The post-mortem examination shows changes such as would be brought about by a severe toxaemia and the nature of the lesions is rapidly masked by post-mortem decomposition. In animals examined immediately after death or killed when on the point of death there is usually observed congestion of the subcutaneous vessels, sometimes a considerable excess of clear straw-coloured fluid in the serous sacs; the liver, spleen, kidneys, and lymphatic glands are congested in varying degrees, the mucous membrane of the abomasum in a few cases shows congestion, while that of the small intestine appears to show invariably intense congestion over a considerable extent of its surface.

In 1911 the author's investigations with regard to the etiology of the disease were all performed with material obtained from sheep recently found dead. It was found that subcutaneous inoculation into susceptible sheep of heart blood and peritoneal fluid from sheep found dead resulted in death. The principal post-mortem lesions produced bore more resemblance to those of malignant oedema than to those of black disease. Feeding experiments with minced up abomasum, intestines, liver, kidneys, etc., were negative. Two main types of bacilli, both anaerobes, were isolated from the sheep found dead, viz., (1) braxy type, (2) malignant oedema type. Experimental inoculation into sheep of the bacillus of the braxy type which was isolated from the sheep found dead of black disease had various results sometimes death, but more frequently only a local lesion with slight systemic disturbance. Feeding experiments on sheep with various bacilli isolated were negative.

With guinea-pigs subcutaneous inoculation of the braxy type of bacillus in young cultures in doses of 0·1 to 0·5 c.c. was invariably fatal within 20 hours, often within 16 hours. With smaller doses (0·05 c.c.) death might be delayed a few hours. Small doses of this organism were not pathogenic to rabbits.

The author, however, hesitated to conclude that this braxy type of organism was the cause of the natural disease in sheep, and thus during the years 1915-1917 he carried out his further researches in the field and observed flocks in which cases were liable to occur in order to study the disease in, and obtain materials for inoculation from, sheep immediately after death or killed just before death would have taken place. Twenty sheep were discovered ill at different times and a number of sheep, guinea-pigs, and rabbits were inoculated subcutaneously, or intraperitoneally with blood, exudates, or emulsions of organs etc., removed from the animals directly they had died of the disease, taking precautions to avoid contamination. No distinct reaction was produced even although large doses were often injected. Similarly cultural examinations gave negative results with only four exceptions, viz., one case in which a Coli-like bacillus was isolated from the liver and mesenteric lymphatic gland, a second case in which a short anaerobe pathogenic to guinea-pigs in large doses but not to sheep was isolated from the hepatic lymphatic gland, a third case in which a short anaerobe non-pathogenic to sheep, guinea-pigs, or rabbits was isolated from the liver, and a fourth case in which an anaerobe producing various results upon inoculation into sheep, fatal to guinea-pigs in rather large doses, but non-pathogenic to rabbits, was isolated from the lung and adrenal gland. These organisms, which were found in exceptional cases, could not be incriminated as the causal organisms. Microscopic examination of smears from organs and tissues likewise gave negative results and similarly histological examination of tissues fixed immediately after death of the animal showed no organisms even although profound structural changes were often observed. No pasteurella organism was discovered in any of the author's cases..

These investigations thus appear to prove conclusively that the braxy-like bacillus discovered in sheep found dead of the so-called black disease soon after death is merely a post-mortem or agonal invader, and the author suggests the probability that the same applies to the anaerobes incriminated as the cause of similar conditions in other parts of Australia and of braxy and bradsot in Europe. Various hypotheses with regard to the etiology of black disease are discussed.

Cross (H. E.). **Some Camel-Feeding Experiments.**—*Agricultural Research Institute, Pusa.*—1918. Bull. No. 77. 8 pp. 1918. Calcutta: Supt. Govt. Ptg., India. [Price As 2 or 3*d.*]

"Our knowledge regarding the quantity of fodder that a camel required is very limited, and no experiments have, so far as I am aware, been carried out to determine the quantity of fodder that a camel requires to keep him in condition. Requests having been frequently made by the military authorities for information regarding the quantity of fodder that should be given to camels, it was decided to carry out some feeding experiments on these animals.

"The only camels available for the purpose were medium-sized camels suffering from surra (7–14 years old). It would have been much more satisfactory had it been possible to carry out the experiments with non-surra-infected camels, but this it was not possible to arrange.

"The camel is an animal that can be trained to eat almost anything, and the fodder on which he feeds varies greatly in different parts of the world. The Punjabi camelmen prefer browsing to stall-feeding, and undoubtedly the camel thrives well if sufficient time is allowed for browsing, and the browsing is of good quality. When the browsing is poor or sufficient time is not available, fodder such as *missa bhusa* (pea straw), *moth bhusa* (*Phaseolus aconitifolius*, straw) and *mung bhusa* (*Phaseolus mungo* straw), and, when in the season, green *tara-mira* (*Eruca sativa*), green *moth* (*Phaseolus aconitifolius*) and green gram are fed to the camels. As a rule the camelman does not feed gram to his camels, being unable to afford it. *Chitta bhusa* (wheat straw) and *phaliyat* (*Eruca sativa* stalks) are occasionally fed. Camelmen however do not like *chitta bhusa* (wheat straw) as a camel fodder and *phaliyat* (*Eruca sativa* stalks) has probably little nutritive value. Without doubt a camel thrives best on fodder and browsing that he has been accustomed to. A camel brought to a district, the browsing in which differs from that to which he has been accustomed or when stall-fed on fodder that he has not been used to, will fall off in conditon; but if he is carefully looked after and only lightly loaded to start with, he quickly becomes accustomed to the change and will rapidly regain his condition.

"Experiments regarding the quantity of fodder a camel will eat were carried out with the following:—

(1) Gram and *missa bhusa.*
(2) *Missa bhusa* without grain.
(3) Gram and *moth bhusa.*
(4) *Moth bhusa* without grain.
(5) Barley, turnips and *moth bhusa.*
(6) Gram and green *tara-mira.*
(7) Green *sarson* (Indian colza).
(8) Oat hay and ordinary hay.

"The camels got poor browsing during the day: the fodder was given in the evening at about 5 p.m.

"Maximum quantity of fodder eaten, in addition to poor browsing.

(1) 12 lb. gram. and 35 lb. *missa bhusa.*
(2) 6 lb. gram and 35 lb. *missa bhusa.*
(3) 39 lb. *missa bhusa.*
(4) 2 lb. gram and 22 lb. *missa bhusa* (2 year old camels).
(5) 6 lb. gram and 40 lb. *moth bhusa.*
(6) 45 lb. *moth bhusa.*
(7) 5 lb. barley, 30 lb. turnips, and 40 lb. *moth bhusa.*
(8) 6 lb. gram and 86 lb. green *tara-mira.*
(9) 192 lb. green *sarson.*
(10) 6 lb. gram and 31 lb. hay.
(11) 17 lb. oat hay.

"*Summary.* The average quantity of fodder eaten, in addition to poor browsing, was as follows:—

(1) 12 lb. gram + 20·6 *missa bhusa.*
(2) 6 lb. gram + 23·1 lb. *missa bhusa.*
(3) 24·9 lb. *missa bhusa.*
(4) 4 lb. gram. + 14·7 *missa bhusa* (2 year old camels).
(5) 6 lb. gram + 26·7 lb. *moth bhusa.*
(6) 29·9 lb. *moth bhusa.*
(7) 5 lb. barley + 26·6 lb. turnips + 26·4 lb. *moth bhusa.*
(8) 6 lb. gram + 66·1 lb. green *tara-mira.*
(9) 135·4 lb. green *sarson.*
(10) 6 lb. gram + 16·2 lb. hay.

"*Conclusions.* Taking into consideration the fact that these experiments were carried out on camels suffering from surra and doing no work, it is probable that healthy camels on hard work would eat very much more. The experiments however show that the present government ration of 16 lb. of a mixture of wheat and *missa bhusa* per camel is insufficient."

TRIBONDEAU (L.). i. **Coloration du sang à l'aide de deux colorants de preparation rapide et facile, genre May-Grünwald et genre Giemsa.** [Staining of Blood Films by Means of May-Grünwald and Giemsa-like Stains, respectively.]—*C. R. Soc. Biol.* 1918. June 22. Vol. 81. No. 12. pp. 639–640.

—. ii. **Coloration du sang à l'aide d'un colorant de préparation rapide et facile, genre biéosinate.** [Staining, etc., by Bieosinate.]—*Ibid.* pp. 641–642.

The method recommended by this author for the manufacture of a Giemsa substitute has already been described in this *Bulletin* (Vol. 6, No. 1, p. 45). The methods of preparation of the products are again briefly indicated in this article.

Preparation of Stain No. 1 (May-Grünwald substitute). Place in a glass vessel capable of withstanding heat

Glycerine (neutral)	5 c.c.
Absolute alcohol (or, if unobtainable, 95 per cent. alcohol)	45 c.c.
Pure medicinal methylene blue	0·2 gramme
French eosin (Pharmacie centrale de France)	0·05 gramme

Close flask by means of a cork perforated by means of a long glass tube, or, if unobtainable, allow flask to remain open. Place the flask in a warmed-up water bath, which is then rapidly boiled. Shake flask in order to accelerate the solution of the staining substances and when totally dissolved withdraw flask from water bath, allow to cool a little, and pour the liquid into a graduated glass vessel. Make up to 50 c.c. with absolute alcohol, or, if unobtainable, 95 per cent. alcohol, filter, place in glass flask.

Preparation of Stain No. 2 (Giemsa substitute).

Place direct in flask

Glycerine (neutral)	25 c.c.
Alcohol (95 per cent.)	15 c.c.
Pure medicinal methylene blue	0·20 gramme
French eosin	0·05 gramme

Dissolve hot as in the case of Stain No. 1. Add 15 c.c. of 95 per cent. alcohol if heating has taken place in a flask left open and not provided with a long tube, in order to compensate for loss of liquid in evaporation. Pour 4 c.c. of ammonia into the stain and mix. Heat in the autoclave at 120° C. for 20 minutes, the neck of the flask being left open. Allow to cool a little, place the stain in a graduated glass vessel, make up to 50 c.c. with 95 per cent. alcohol, place in flask which is not stoppered until after about a day or two.

Process of staining. Fixing. The blood smear, spread in a thin film and allowed to dry is placed flat on a table, film side upwards. Cover with Stain No. 1, place over the slide the lid of a Petri dish in order to guard against too rapid evaporation, allow to act for three minutes. Wash in a jet of distilled water, shake off excess of water, allow slide to rest on the margin of a glass vessel or Petri dish without drying.

Staining. In a small tube graduated to 2 c.c. place 2 c.c. of distilled water, heat in a flame until air bubbles begin to rise, add by means of a pipette 4 or 5 drops of Stain No. 2. Pour hot on smear, allow to act for 15 minutes. Wash in a jar of distilled water, dry by holding over the flame for about 2 seconds and blowing on the preparation.

Differentiation. Pour on the *dry* preparation held inclined a 5 per cent. solution of tannin until the blue colour just turns to red, wash quickly with distilled water and dry rapidly (by heating and blowing).

This method of staining is useful in searching for haematozoa and other blood parasites. It can also be used for routine study of the cytology of the blood. Its great advantage lies in the fact that it can be carried out with any kind of distilled water and precipitates are not thrown down.

ii. This new stain (Stain No. 3) is a neutral solution of eosinate of methylene blue transformed by means of ammonia. It is very easy of preparation.

Preparation of Stain No. 3. Heat distilled water to boiling point and divide as follows:—

A—50 c.c. in an enamelled vessel. Add 0·20 grammes of pure medicinal methylene blue, shake until dissolved.

B—75 c.c. in a glass vessel. Add 0·30 grammes of French eosin. Shake until dissolved.

Pour B little by little into A. Mix for some time with a glass rod after each addition of eosin, then place on a slide the drop remaining suspended to the rod when withdrawn. This is first of a deep blue tint and free from precipitates; then as the proportion of eosin is increased the blue becomes pale and precipitates appear; finally the precipitates increase and the liquid turns to a rose colour. Stop the addition of eosin when the colour of a drop becomes pale rose, that is to say, immediately the liquid has turned from blue to red. Ordinarily it requires the addition of rather more than 50 cc. of the. eosin solution in order to obtain this result.

Add 4 c.c. of ammonia, mix, heat in an enamelled dish covered with an inverted jar at 120° C. in the autoclave and then allow to become quite cool after having well shaken, the stain by means of a glass rod. Filter the mixture through a small filter paper (e.g., about 75 mm. in diameter). The reddish coloured filtrate is thrown away. Withdraw the filter paper from its funnel and place it on several layers of ordinary filter paper so as to form an absorbent pad. Unfold and spread the filter paper in order to facilitate desiccation of the precipitates on its surface. Allow to dry in the incubator at 37° C. The dish utilised in the preparation of the stain is also allowed to dry; when the filter paper and the dish are absolutely dry (an important condition inasmuch as all the ammonia must have become evaporated) loosen by means of a scalpel the stain adherent to the filter paper and allow it to fall into the dish and crush up by means of a large glass rod. Take 100 c.c. of glycerinised alcohol (absolute alcohol 90 c.c. and glycerine 10 c.c.) and pour little by little into the dish and by agitating with a glass rod there are thus dissolved the stain adhering to the wall of the dish, the staining powder detached from the filter paper and the stain adherent to the paper (crush the paper in contact with the solvent). Place in a well stoppered flask the liquid thus run off successively and carrying with it the still undissolved powder. Allow to dissolve for at least 12 hours, shaking the flask from time to time if possible. Filter through filter paper.

Process of staining. Stain No. 3 is employed like bieosinate.

Fixing. The smear (spread in a thin film, dried, and bordered at one end by a grease pencil mark) is placed horizontally on a table smear side upwards. Cover smear with 0·2 c.c. of the stain (about 4 drops), cover slide with lid of Petri dish, allow to act for 3 minutes.

Staining. Add 0·6 c.c. distilled water (or about 12 drops), mix by moving the slide a few times, then allow to remain horizontal. Allow to act for 10-15 minutes without touching. Wash with distilled water, shake off excess, dry rapidly (by passing for 2 seconds over the flame and blowing strongly on the preparation).

This stain is remarkably selective and complete. It reveals very fine details of cells and parasites that are not shown up in the method first described (notably all the basophile granules of mononuclears). It is the best method for all detailed blood studies, but it has the disadvantage of requiring the use of very pure and neutral distilled water (if necessary re-distilled on carbonate of silver).

REPORTS.

MUKTESAR LABORATORIES. **Annual Report of the Imperial Bacteriologist for the Year ending the 31st March, 1917.** [SHEATHER (A. Leslie).] —25 pp. With 2 tables. 1918. Calcutta: Supt. Govt. Printing. India. [Price annas 5 or 6*d.*]

This is the first Annual Report furnished by Sheather since he took up the duties of Imperial Bacteriologist in October 1916 in succession to the late Colonel HOLMES. The duties of Imperial Bacteriologist up to the time of Sheather's arrival were temporarily carried out by the Assistant Bacteriologist, SHILSTON (A. W.), who presented the preceding report [see this *Bulletin*, Vol. 5, No. 1, p. 66] and has also furnished some important observations on rinderpest [this *Bulletin*, Vol. 5, No 2., p. 120 and Vol. 6, No. 1, p. 25]. The services of the Pathologist and Physiological Chemist were during the year placed at the disposal of the military authorities. In spite of this reduction in the staff, however, the production and issue of serum and vaccines from the laboratories during the year showed a general increase. Details are first given with regard to administration, including new arrangements made for fodder, fuel, and water supplies. The Assistant Bacteriologist made a number of tours for investigation and advisory purposes and with regard to the construction of the new branch laboratory at Izatnagar. The Pathologist (MACALISTER G. H. K.) carried out investigations in connection with "kumri" in Assam.

As in previous years the chief work of the laboratory consisted in the preparation of anti-rinderpest serum. There was an increased demand for this product owing to the prevalence of the disease in nearly all provinces. 1,243,670 doses were prepared and 1,409,220 were issued as against 1,186,550 doses prepared and 969,460 doses issued during the year 1915–1916. In a table the results obtained by the use of the serum in the various provinces are given and inasmuch as the mortality rate among the whole number of inoculated animals amounted only to 0·49 per cent. the author feels "justified in concluding that this serum is of the utmost practical value." Extracts are quoted from the reports of the Superintendents of the Civil Veterinary Departments Assam, Bengal, and United Provinces with regard to the efficacy of the serum in the field.

11,029 doses of anthrax serum were prepared and 29,069 issued as compared with 71,870 doses prepared and 48,337 issued during the preceding year. The manufacture of this serum was regulated according to the demand.

Haemorrhagic septicaemia serum and vaccine.—122,915 doses of serum were manufactured and 157,065 issued during the year under report as against 127,365 doses prepared and 79,965 issued during the preceding year. The number of doses of vaccine prepared and issued during the year was 146,540 as against 124,150 prepared and issued in 1915-1916. There was an increased demand for both these products and steps were taken to augment the supply. Very satisfactory results were reported after the use of the serum by the Superintendent, Civil Veterinary Department, Bombay Presidency; "generally satisfactory results" were also reported after the use of vaccine by the Superintendent, Civil Veterinary Department, United Provinces. The serum is recommended for use to check actual outbreaks of the disease while the vaccine is used in areas where the disease is enzootic at the beginning of the seasons when it is most prevalent.

Blackquarter vaccine.—23,350 doses were issued as against 20,257 doses during the preceding year. Reports from the United Provinces and the Punjab indicate the beneficial results obtained by the use of this product. Strangles serum and vaccine, mallein and tuberculin were also prepared and steps were taken to increase the output of the last-named product. A number of special or autogenous vaccines were also prepared. The routine laboratory work also included diagnosis of a number of morbid specimens received for examination.

A study of the complement fixation test and its application to the diagnosis of dourine in India was taken up by SHILSTON early in the year. The "discovery that this disease was widely established in the Punjab and Baluchistan and threatening seriously to interfere with horse breeding operations, made the working out of a reliable diagnostic method a matter of great importance."

An account is given of inoculation work performed at the Military dairy farms.

"Several factors have combined to limit the amount of research work that could be carried out during the past year. The routine work of the laboratory and the difficulties of administration were greatly increased." A good deal of work was performed with a view to improving the methods of serum production, especially in the case of rinderpest. A report on the disease of horses known as "kumri" has been published by the Pathologist.

Contagious abortion in cattle was reported from some of the military dairies.

Some experiments were performed in connection with pleuro-pneumonia of goats. Also, the treatment of surra was further investigated but without success.

The appearance of foot-and-mouth disease in the animal sheds of the laboratories in November 1916 caused great difficulties in providing accommodation for segregated as well as healthy animals. Additional difficulties were caused by a serious outbreak of relapsing fever among the coolies employed in December 1916 but fortunately by the prompt undertaking of sanitary measures the disease was soon brought under control. The following table showing the aggregate results from the reports of the various Provinces gives some indication as to the value of the products issued by the laboratories.

Disease	Product employed.	Number of outbreaks in which inoculation was undertaken.	Number of animals which died uninoculated in course of disease.			Number of animals inoculated.			Number of animals which died after inoculation.			Percentage of deaths in inoculated bovines.
			Equines.	Bovines.	Others.	Equines.	Bovines.	Others.	Equines.	Bovines.	Others.	
Rinderpest ..	Serum	3,645	..	57,878	87	..	522,273	810	..	2,611	10	0·49
Anthrax	,,	81	23	547	374	364	6,107	650	..	11	32	0·18
Haemorrhagic Septicaemia	Serum	562	..	4,504	8	..	82,019	292	..	93	..	0·11
	Vaccine	265	..	170	..	..	56,990	..	..	15	..	0·02
Blackquarter ..	Vaccine	93	..	22	..	..	11,042	..	..	38	..	0·03

Bengal. **Annual Report of the Bengal Veterinary College and of the Civil Veterinary Department, Bengal, for the Year 1916-1917.** [Smith (A.), Principal and Superintendent.]—4+ii+5+viii+2. With 14 tables. 1917. Calcutta: The Bengal Secretariat Book Depot. [Price 10*d.*]

In the first report the author gives a brief account of the general administration and veterinary instruction at the Bengal Veterinary College, the Epizootic Diseases of Animals Department Calcutta, and the Raymond Research Laboratory. The number of students at the College at the end of the session was 148. There has been a steady increase in the number of students but it appears that there remains a demand in the Presidency for qualified veterinary assistants which is not yet satisfied by the supply of candidates. The three years course in English at the College is provided free of charge but it seems difficult to induce native Bengalis to undertake the studies.

In the report of the Civil Veterinary Department the treatment of diseases and administration of hospitals and dispensaries and breeding operations are described. Cases of glanders, anthrax, and surra were reported among horses. Surra has lately been scheduled under the Glanders and Farcy Acts and it is hoped that destruction of affected animals will tend to the stamping out of the disease.

There was considerably less mortality from rinderpest in the course of the year as compared with previous years and it is stated that even better results could have been obtained if earlier reports of outbreaks were furnished. Foot-and-mouth disease prevailed in almost all districts, and although not so fatal as some other diseases it is a great menace to the agricultural community. The mortality from haemorrhagic septicaemia was greater than usual -1,957 as against 880 in the previous year. A considerably increased number of animals were inoculated against this disease. A few cases of deaths from blackquarter, anthrax, surra, and some other diseases were reported. The numerous tables appended include statements showing the results of preventive inoculation during the year.

BURMA. **Report on the Civil Veterinary Department (including the Insein Veterinary School) for the Year ended the 31st March 1917.** [EVANS (G. H.), Superintendent.]—13 pp. f'cap. With 7 tables & 1 map. 1917. Rangoon: Office of the Supt. Govt. Printing. Burma. [Price As. 8 or 9*d*.]

During the year under consideration 59 pupils were trained at Insein, where they are put through a three years' course, while a few were also put through a short course at the Veterinary School, Taunggyi, Southern Shan States. Great difficulty was experienced in obtaining suitable candidates for admission to the schools. A large number of interesting specimens were examined at the laboratory of the Insein college.

The most serious diseases appear to have been rinderpest, anthrax, and foot-and-mouth disease, but the year was remarkably free from contagious diseases of cattle. The recorded deaths from rinderpest were only 2,058--a tenth of the mortality from the same disease in 1912-1913. The Akyab and Salween districts were responsible for half the cases; the former district is annually a large contributor to the total number of deaths from this disease and it is hoped to make early arrangements for the adoption of preventive inoculation measures in this district. The number of deaths from rinderpest was considerable in only two of the districts where anti-rinderpest serum was used during the year. Preventive inoculation was also undertaken with success in the Northern Shan States. Foot-and-mouth disease, on the other hand, was more prevalent than in 1915-1916, causing over 5,000 deaths as against 1,800 in that year; it was especially virulent in Bassein, Myaungmya, Kyaukpyu, and Myingyan.

Progress was made in bringing the subordinate establishment up to the sanctioned strength; at the close of the year there were 15 veterinary inspectors and 142 veterinary assistants in Burma proper as compared with 12 and 130 respectively twelve months before. These numbers, however, are quite inadequate to cope with the work owing to the large extent of the areas now under the control of individual assistants.

Breeding operations appear to be at a standstill.

In the map given the areas affected by the principal contagious diseases are indicated.

UNION OF SOUTH AFRICA. **Department of Agriculture. Report with Appendices for the Year ended 31st March, 1917.**—158 pp. f'cap. 1918. Cape Town: Cape Times, Ltd. [Price 4*s*. 3*d*.] (Appendix III. Veterinary Research. Annual Report of the Director [THEILER (A.),] 1916-1917. pp. 45-50.)

In this important report an account is first given of the very considerable routine work performed at the Onderstepoort Laboratory and the branch laboratories at Grahamstown and Pietermaritzburg. This includes visits made for purposes of investigation into various districts within the Union of South Africa by members of the research staff. The following summary account of the work done in connection with the various diseases prevailing in South Africa is reprinted in full as one could not very well do justice to it in an abstract.

"*Microscopical and Pathological Anatomical Examinations.*—The total number of specimens and smears examined at the three laboratories amounted to 21,779, an increase of 45 per cent. over the previous twelve months. The distribution was 13,556 at Onderstepoort, 937 at Grahamstown, and 7,286 at Pietermaritzburg. At Onderstepoort this branch of the routine work occupies a good part of the time of three of my Research Officers, and leaves them but little opportunity for research work. At Pietermaritzburg, where there is only one Research Officer, this work constitutes even a heavier drain on his time, and as soon as opportunity permits, I intend placing another officer there.

"*Blue Tongue Vaccine.*—1,244,050 doses were issued during the year under review. This figure shows a slight falling off when compared with that of the previous 12 months, but brings the total issues up to 6,860,589 doses since the method was first introduced. I am glad to report that notwithstanding the numerous difficulties we had in coping with the heavy demands no untoward results were reported from the practice.

"*Redwater and Gallsickness Vaccine.*—The total issues of this vaccine from the three laboratories amounted to 18,069 doses, the distribution being 7,222 doses from Onderstepoort, 6,357 doses from Grahamstown, and 4,490 doses from Pietermaritzburg. The total output shows an increase of 60 per cent over the previous year.

"*Anthrax Vaccine.*—The preparation of Anthrax vaccine at Onderstepoort was continued, and our supplies from the Institute Pasteur, Paris, were reduced to a minimum. Out of the total number of 696,850 doses that were issued during the year 632,350 doses were prepared at Onderstepoort, the balance of 64,500 being imported from Paris. The issue this year broke all records, being an increase of over 70 per cent. on the output for 1915–16, and my limited staff was taxed to the utmost to comply with the demand. When it is considered that in the five years from 1911 to 1916 only 828,355 doses were supplied and yet in the 12 months under review 696,850 doses were issued, of which 91 per cent. was prepared at Onderstepoort, it will be readily understood that complaints of delays could not be avoided. I was unable to obtain the services of any extra officer to cope with this extra work, and the only additional facility that was available was the newly erected Anthrax Vaccine building.

"The issues during the year 1916–17 consisted almost entirely of the method known as the single vaccine, for which only one injection was necessary, but by the end of the year it had become evident that the single method, generally speaking, was not so satisfactory as the double method for which two injections are necessary. Naturally, the re-introduction of the double method involves exactly double the work, but luckily the difficulty experienced last year by reason of the shortage of bottles and tubes has now been overcome to a large extent, and it is hoped that if farmers return empty bottles, our stock will suffice for requirements. I am also glad to be able to report that, generally speaking, the results of the vaccine were as satisfactory as could be hoped for.

"*Black Quarter Vaccine.*—The number of doses prepared at Onderstepoort and issued during the current year amounted to 223,896, again an appreciable increase on the corresponding figure for 1915–16, namely 185,830.

"*Inoculation of Mules against Horse-sickness.*—The number of mules inoculated during the period under review was very small, comparatively speaking, only 295 being done, four deaths occurring, or 1·4 per cent.

"*Inoculation of Horses against Horse-sickness.*—The improved method of inoculation of horses was introduced in the practice in September 1916, after it had been ascertained from both experiments at the Laboratory, and experience at Roberts' Heights on horses belonging to the Military, that the results were likely to be satisfactory. Some 400 horses were inoculated at the Laboratory with a mortality of 3·5 per cent., whilst at Roberts' Heights, 1,609 were inoculated with a mortality of 4·5 per cent. Between September and December 1916, some 1,250 horses were inoculated for farmers, the mortality being 7 per cent., but unfortunately by the time the last batch was inoculated, reports had been received to the effect that deaths were occurring from some unknown cause in those batches of horses that were done at the commencement. Inquiries were immediately instituted, and before very long it became quite evident that this new disease was one known as Staggers, and as this disease appeared amongst each batch of horses at the different inoculation centres about 2 months later, there were some grounds for supposing that the inoculation was connected with Staggers in some way or other. Later investigations made it quite clear that the serum and virus used for the inoculation were not the actual cause of Staggers, but that the fever resulting from inoculation was probably responsible for bringing out this disease in horses that might otherwise not have developed it. This theory, therefore, presupposes a derangement of the liver in horses at the time of inoculation, but our inquiries have not yet been completed, and these views may be modified at a later date.

"It is of particular importance to record that cases of Staggers have recently been brought to my notice by farmers amongst horses that were never inoculated, but that are supposed to have salted in previous years. Cases of Staggers have also occurred amongst uninoculated horses kept at this Laboratory, and amongst uninoculated horses belonging to the Military Authorities. It is hoped that further investigations, with particular reference to material from these cases, may help to elucidate the cause.

"Although the Government was not legally liable for the payment of compensation in respect of horses that contracted Staggers after inoculation, yet I considered it very desirable to recommend the adoption of such a principle on the ground that it was impossible to warn the farmer at the time of inoculation that such a contingency might be expected. All claims for compensation have been closely scrutinised and, with very few exceptions, all claims have been settled, either by the payment of cash to the amount for which the horse was insured at the time of inoculation, or by the issue of an inoculated horse of the equivalent value in lieu. Up to the 31st March 1917, just over 150 claims had been approved, and it is anticipated that by the time all claims have been received, compensation will have to be paid for about 200 horses. The total amount involved in the payment of compensation will probably be about £3,000, but as I pointed out at the time my recommendations were made, I considered the principle of paying compensation would show the farmers that we were doing our best to help them out of the difficulty and, what is of more importance, would restore their faith in the method of inoculation.

"The outbreak of this new disease was a very severe blow to me, and is, in fact, the most disheartening incident that has occurred in the whole of my investigations into Horse-sickness. The mortality from inoculation was quite reasonable, and as will be seen from the figures quoted above, under the worst conditions under 7 per cent. of the horses that were inoculated died under the treatment, whilst in regard to the immunity, this was the best that had been given by any of our methods.

"The immunity tests this year were undertaken in two places, first of all at Onderstepoort and at Doornpoort a farm adjoining our Laboratory, where 216 inoculated horses were exposed during the summer months, amongst which a mortality occurred to the extent of 4 per cent. The second batch of horses, numbering 50 were exposed in a very unhealthy area at Enselini in Zululand, and in this batch also the mortality only amounted to 4 per cent

"*Wire- and Tape-worms in Sheep and Lambs.*—The introduction of a new remedy for the treatment of wire-worms and tape-worms in sheep and lambs was commenced at the beginning of March 1917, and up to the end of the month 200,000 doses had been issued. Before introducing the remedy into practice on a large scale, Mr. Robertson, M.P.C., of

Amersfoort, kindly offered to subject the remedy to an extensive test on his farm, and I am glad to report that favourable results were obtained by him. In order to obtain the desired results, it is essential that the remedy should be given in the doses prescribed, and for this purpose sets of spoons have been made to my specification, each spoon marked in a distinctive manner and holding the exact dose for lambs and sheep of various ages. A dosing bowl is also supplied to facilitate the handling of the powder, and both spoons and dosing bowls are manufactured by a private firm. These articles are retailed to the farmers at practically cost price.

"*Research work.*—The lack of professional staff has prevented me from undertaking detailed research work into many of the diseases that require investigation, but notwithstanding our many difficulties I am glad to say that we have had positive results from two of our investigations, namely, Jagziekte in horses and Geeldikkop in sheep. A short review of the lines on which research work was undertaken is given under their respective headings.

"*Horse-sickness.*—Experiments were undertaken with a view to simplifying the method of inoculation and of conferring a better immunity to horses. The results proved very satisfactory in the experimental inoculations, a mortality of under 4 per cent. occurring during treatment, whilst the immunity held to the extent of 96 per cent. In other words we could safely expect to save 9 out of 10 horses. Unfortunately, as I have reported earlier, when the method was introduced into the practice a sequel occurred, a new disease, Staggers, making its appearance amongst inoculated horses to the extent of about 15 per cent.

"*Slapziekte in Horses.*—Investigations were made in the Griqualand area into a disease known as Slapziekte and the opinion has been arrived at that the disease is that known in other countries as Dourine. All attempts to transmit the disease artificially into control animals have so far failed, but research is being continued.

"*Jagziekte in Horses.*—With a view to comparing the flora on farms where the disease is known, Mr. Pole Evans, the Chief, Division of Botany, accompanied me on several visits to various farms in Natal. Experiments were continued with a view to ascertaining the cause and manner of transmission of this disease, and just before the close of the financial year the third successful attempt at transmitting the disease artificially was achieved. Although the enquiries are by no means completed, it seems evident that the disease is contracted by eating a plant Crotolaria dura, which is only known in certain parts of Natal where the diseases exist. I would also like to mention that it was due to the observations of Mr. Rabe of Singletree, Natal, that we were able to solve the cause of this disease.

"*Dunziekte in Horses.*—Experiments with a view to ascertaining the cause and nature of the disease were continued, 50 horses being exposed in Mooi River, Natal. So far no positive results have been obtained.

"*Miscellaneous Horse Diseases.*—Various investigations and some control experiments have been undertaken into diseases of horses such as Staggers, which appeared in connection with the inoculation against Horse-sickness and Pernicious Anaemia.

"*Anthrax.*—With a view to overcoming the difficulty experienced in the past as a result of incomplete immunity given by the Anthrax vaccine obtained from the Institute Pasteur, experiments were made to increase the dose of vaccine to be injected, and a new procedure has now been adopted on these lines.

"Attention was paid to the possibility of Anthrax infection existing in dams and numerous attempts were made to reproduce the diseases by the injection of animals with muddy water taken from suspected dams. So far three positive results have been obtained. These results are very interesting as they show the extent to which Anthrax infection must be prevalent.

"*Trypanosomiasis (Tsetse disease, Nagana).*—Mr. Mitchell, the Veterinary Research Officer at Pietermaritzburg, was detailed to make a thorough enquiry into the prevalence and spread of Nagana in Zululand, and his preliminary report has been submitted.

"Experimental inoculations into small animals were also undertaken at the Laboratory in Pietermaritzburg to determine species and infectivity of the parasites.

"*Lamziekte in Cattle.*—Attempts were made at Onderstepoort to reproduce Lamziekte by allowing cattle to lick soil from Lamziekte areas, and also by letting them graze on such soil spread over our own veld. No results were obtained.

"Research into Lamziekte at Vryburg has been hampered owing to the lack of suitable accommodation, but arrangements have now been made for the erection of some of the buildings to be put in hand without delay.

"Out of the various experiments that were undertaken at Vryburg the only point of any practical importance that was arrived at was, that the feeding of cattle with good foodstuffs and licks did not seem to ward off the disease. The opinion that the disease is connected with the pasture has again been supported by our observations.

"It had originally been arranged that some experiments into Lamziekte should be undertaken at Bestersput, O.F.S., but, unfortunately, the idea had to be given up chiefly owing to the shortage of staff. The farm has been used for the grazing of stock and only minor farming operations have been undertaken.

"*Imapunga in Cattle (or Black Lung).*—The experiment commenced in 1915 on the farm Palmerston near Grahamstown, had to be discontinued owing to the disease failing to put in an appearance. Mr. Robertson, the Veterinary Research Officer at Grahamstown, made enquiries with a view to ascertaining if there was another suitable farm, and as a result Mr. White, the owner of the farm Palmiet was good enough to place his farm at our disposal. Some 50 head of cattle were exposed there and arrangements were made for inoculation and drenching experiments in the Grahamstown laboratory. No disease appeared, however, by the end of the year, and it seemed generally to be in abeyance throughout the whole area.

"*Stijfziekte in Cattle.*—Through the assistance of the Chief of the Division of Botany, Mr. Pole Evans, a number of farms in Natal were inspected and extensive notes made concerning the distribution of the various plants and grasses. At one of the farms so inspected, namely, Lidgetton, Mr. Thompson, the owner, was good enough to offer the Division his assistance, and as a result an experiment was undertaken to see whether cattle obtained from a clean area would contract Stijfziekte when exposed on that farm, and if so, after what period. The results were that within 6 months after exposure about 50 per cent. of the cattle contracted the disease.

"At the same time a number of cattle suffering from Stijfziekte were purchased from Mr. Thompson and removed to the Laboratory at Onderstepoort with the object of ascertaining whether such animals would improve in condition after being removed from the farm, and how long it would be before recovery was complete. Although the experiments are by no means completed, it seems fairly conclusive that if cattle suffering from Stijfziekte are removed to a clean farm, and fed on good rations the majority recover.

"*Contagious Abortion in Cattle.*—Investigations were continued into several points of interest especially in connection with the length of time cattle remain infected with this disease. Valuable information is at hand and will be published in the next annual report.

"*Gauwziekte in Sheep.*—An opportunity of investigating this disease was afforded through the assistance of Mr. Strydom, of Kaalfontein, near Pretoria. Different batches of sheep were exposed on this farm for varying periods, and then returned to Onderstepoort and kept under observation. At the same time feeding experiments were undertaken at the laboratory with plants that Mr. Pole Evans considered might be responsible. No results were obtained before the end of the financial year.

"*Geeldikkop in Sheep.*—Through the kindness of Mr. du Preez, of Bergrivier, Luckhoff district, an excellent opportunity occurred for carrying our further experiments into a disease in sheep known as

Geeldikkop, that is very prevalent in the Karroo. In the opinion of the farmers the disease was due to sheep eating a plant known as Dubbeltje, and although experimental tests had been carried out on several occasions previously with negative results, it was considered advisable to carry out a thorough feeding test with this plant in its fresh state, and I am glad to be able to report that our efforts were successful. The disease appeared promptly after a batch of sheep were fed on the dubbeltje and the explanation for our previous failures must lie in the fact that the plant only produces the disease when fresh and in a particular stage of its growth.

"I am indebted to Mr. Pole Evans for his valuable assistance in undertaking the Botanical survey of the farm in question.

"*Paralysis in Ostriches.*—With a view to ascertaining whether paralysis in ostriches is due to the wire-worm infection an experiment was commenced in Grahamstown in which numbers of these parasites were fed to birds, and it appears that an extensive infection is the cause."

UNION OF SOUTH AFRICA. **Department of Agriculture. Report with Appendices for the Year ended 31st March, 1917.**—158 pp. Fcap. 1918. Cape Town: Cape Times, Ltd. [Price 4*s.* 3*d.*] (Appendix I. Veterinary Division. Annual Report, 1916–17 [BORTHWICK (J. D.)], Acting Principal Veterinary Officer], pp. 29–38.)

In the absence of the Principal Veterinary Officer (GRAY (C. E.) in German East Africa on special duty in connection with the outbreak of rinderpest in that country [see this *Bulletin*, 1918, Vol. 6, No. 2, pp. 115–118] the report of the Veterinary Division is furnished by Borthwick (J. D.).

East Coast Fever continues to take up most of the time of the officers of the Division. Taking the Union as a whole the position has improved but in the separate provinces the outlook is regarded as being none too bright.

Cape Province is fortunate in having had no fresh outbreaks during the year. There remain only two areas under quarantine, viz., in the Komgha district, and as no cases of the disease had occurred in this district since the preceding May it is hoped that the whole of the Cape Province may be declared entirely free of East Coast Fever shortly. The existence of the disease in the bordering Transkeian districts still remains a serious cause of anxiety.

Transvaal. Although the number of fresh outbreaks is 11 less than in the preceding year the position is rather disappointing as the disease developed alarmingly in the Pietersburg district (12 fresh outbreaks) where it was considered well under control. There were also 8 new outbreaks in the Barberton district but the rugged nature of this district makes the task of combating the disease a difficult one. In the first named district the spread of the disease is stated to have been entirely due to lack of co-operation on the part of farmers. The author gives particulars of four serious outbreaks the presence of which had been hidden as long as possible or dipping had been performed just sufficiently to check mortality. In the meantime infection had spread through the medium of joint dipping and grazing to other farms. It is hoped that the further spread of the disease will be checked when farmers have become more enlightened as to the urgent necessity of regulation dipping. In the Zoutpansberg district only 1 death occurred but unfortunately it kept a large native area in quarantine. The Waterberg district unfortunately became re-infected but owing to prompt measures the outbreak remained circumscribed. In the Piet Retief district very good progress was made and this is attributed entirely to the fact that the district is now well provided with tanks. No new outbreaks occurred in the Ermelo district which in all probability will shortly be declared clean. Seven fresh outbreaks occurred in the Carolina district and here control is difficult as only a few of the farms are inhabited by Europeans. On one farm where no dipping facilities were available the natives were persuaded to slaughter off the whole of the infected herd.

Natal. Owing to the fact that so many districts are infected the position is dealt with in a general way. It is regretted that the progress made towards the eradication of the disease in this province is somewhat disappointing, and this state of affairs is attributed largely to the fact that there are so many absentee landlords. The number of outbreaks occurring during the year was 126 as against 91 in the previous year, and here again many of them had been in existence for a considerable time before they were detected. In a good many instances where the disease was diagnosed early and 3 day dipping and hand dressing promptly adopted beneficial results were obtained. In a country like Natal the difficulties of making an early diagnosis in the case of outbreaks of disease such as East Coast Fever are considerable and especially when the farmer fails to do his part in assisting the officers of the Department. As the majority of cases do not come to light until they have been in existence for some time and the adult brown tick is prevalent and consequently infected, five-day dipping is now enforced in preference to three-day dipping. Doubtless three-day dipping gives good results in the hands of farmers who attend to all necessary details but in general practice five-day dipping gives better results; it is stated that even if the dip employed in the five-day system is below strength it still has a chance of retaining its tick destroying properties whereas the three-day dip slightly below strength is far too weak to ensure the desired result. [It is assumed that the dip recommended for use in five-day dipping is stronger than that used in the three-day system.—Ed.] In both cases hand dressing is essential. As a further precaution in cases where quarantine might have been raised too early, movements of cattle from recently released properties are only permitted provided the cattle can be kept under observation for 30 days on an approved property at their destination. Special consideration is given to cases where the infection is slight, and ox transport is only permitted within the owners' property. Progress is made in the erection of dipping tanks but difficulty is experienced on account of absentee landlords. It has been found necessary to stop to a large extent the holding of central public sales. In one or two isolated cases the slaughter of surviving cattle has been resorted to as a means of exterminating the disease.

Considerable progress has been made in the Transkeian Territories during the year and as a consequence the cattle are steadily increasing in numbers in the majority of districts. The natives generally are realising the advantages of efficient dipping and the Transkeian General Council is exerting every effort to provide funds for the erection of as many tanks as possible. The sum of £10,000 is being placed on the estimates for the coming year for this purpose. The working of these tanks has been placed under the direction of the Veterinary Division whose intention is to attend to the border districts first, in order to create a belt of clean areas which would act as a buffer for the adjoining districts of the Cape proper and Natal.

Tuberculosis. Owing to lack of funds and shortage of staff the endeavours of the Department to eradicate this disease were seriously handicapped. The question of increasing the amount of compensation payable under the Act has again been brought forward for discussion but as yet no decision has been arrived at. In the four closed districts of Cape Province 4,695 cattle were subjected to the tuberculin test before removal to other districts; 137 reacted and were destroyed, giving a percentage of 2·92 reactors. In the Transvaal there were 18 outbreaks as against 13 during the previous year; 663 cattle were tested, of which 39 reacted and were destroyed. The number of outbreaks, however, by no means indicates the true position as regards the prevalence of the disease in the Transvaal as it was found impossible to make a study of its distribution.

In Natal 4 outbreaks were dealt with; 1,339 cattle were tested of which 75 reacted. In the Transkei it was found possible to test one herd only of 360 animals; 47 reacted. No outbreaks were dealt with in the Orange Free State. Owing to the war the arrangements made for the application of the tuberculin test overseas in the case of animals intended for import have not been made use of; 455 cattle were tested at the ports of entry, 16 reacted and were destroyed.

Anthrax. This disease is responsible for more losses among stock than all the other contagious diseases put together with the exception of East Coast Fever, and it appears to be spreading rapidly throughout the Union and is becoming a serious menace to both human and animal life. This state of affairs is largely due to the negligence on the part of farmers and natives especially, inasmuch as carcases of affected animals are not buried intact. In some districts of the Transvaal anthrax is very prevalent; the skinning and opening of the carcase of an animal found suddenly dead should not be permitted until examination of a blood smear has proved that the animal did not die of anthrax. The advisability of applying this regulation to the whole of the Union is a matter that will have to be considered

"*Glanders.* With the exception of the Cape Province, this disease, ... is not very prevalent in the Union. Glanders is the usual war legacy, and the present war is no exception, and accounts for the increase in the number of outbreaks in the Cape Province, where military horses and mules, sold after the German South-West African Campaign, were distributed.

"An epidemic of influenza affecting equines, a disease which conceals the symptoms of Glanders, further abetted the spread of the disease.

"*Lungsickness.* No cases of this disease were reported in the Union during the year.

"*Equine Scabies* (*Mange*). With the exception of the Cape and Transvaal, this disease is not very prevalent in the Union. . . . In the Cape Province it is chiefly prevalent in Humansdorp, Uitenhage, and Port Elizabeth districts, most of the affected animals being donkeys owned by poor whites and coloured people.

"*Epizootic Lymphangitis.* This disease is only slightly prevalent in the Union, chiefly in the Humansdorp district in the Cape Province. The most expedient, economic and effective method of dealing with this disease is to destroy the affected animals.

"*Contagious Abortion.* This disease is somewhat prevalent throughout the Union, and its eradication presents some difficulty, as the quarantine policy is, unfortunately, not one that attracts the co-operation and support of the farmers in the detection of the disease. During the year 46 cases have been reported, the agglutination test being applied in most cases.

"*Trypanosomiasis.* Nine cases of this disease were reported in Natal during the year—one in Entonjaneni District, and eight in the Lower Umfolozi District. The infected animals, 20 in number, were 14 cattle, 5 donkeys, and 1 mule.

"*Swine Fever.* Only one outbreak of this disease was reported, it occurred in the Transvaal, and even in this solitary case, owing to the ultimate result thereof, there is an element of doubt as to whether the disease was really Swine Fever.

"*Dourine.* On account of the detection of a suspected outbreak of 'Dourine' in the district of Herbert, Cape Province, this disease was added to the list of diseases scheduled under the Animal Diseases Act, in order that the Minister might have the necessary legal power to deal with animals suspected of being infected with it. Investigations are still proceeding in connection with the suspected outbreak in Herbert.

"It is a disease of considerable economic importance. Treatment is unavailing, and the destruction of the infected animals, with payment of compensation, is the only effective method of preventing its spread.

"*Redwater.* This disease is reported as spreading in the south-western districts of the Cape Province, more especially in the Caledon and Swellendam Districts. In the Orange Free State, where at one time it was not known to exist, it has appeared in the Senekal and Ladybrand Districts.

"*Geeldikkop.* Owing to the drought this disease, which is generally so prevalent in the Orange Free State and Cape Provinces, was not so prevalent this year, more especially in the latter Province. Investigations as to the true nature and cause of this disease are still proceeding.

"*Quarter Evil.* This disease was very prevalent in the Transvaal, and caused considerable loss to the farmers. In the Transkei, however, it was not so prevalent. Inoculation was carried out to a large extent, and the officers of the Division gave several inoculation demonstrations for the benefit of the farmers and natives with, it is considered, very good results.

"*Blue Tongue.* This disease has been less severe, especially in the Cape Province, where probably the drought influenced its prevalence. Inoculation was carried out to a great extent.

"*Horsesickness.* This disease was again to the fore in the Transvaal, and caused heavy losses. A large number of equines were inoculated by the Veterinary Officer, but, unfortunately, losses from a form of 'staggers' ensued, and the method had to be stopped, in so far as horses were concerned.

"*Dunziekte.* In the Transkei, more especially in Mount Currie District, this disease was the cause of a considerable mortality amongst equines. Investigations in connection therewith are at present engaging the attention of the Veterinary Research Division.

"*Mealie Poisoning.* In August last, in the Estcourt Division, Natal, serious illness and many deaths were reported amongst cattle which had been turned into mealie fields. A quantity of 'mouldy' mealies were picked up on the fields and sent to the Allerton Laboratory for experiments, with the result that it was definitely proved that 'mouldy' mealies are poisonous. No medicinal treatment appears to be of any avail, but the farmer, of course, has the remedy in his own hands—*i.e.*, the removal of all such diseased mealies from the fields before the cattle are turned into them."

Some notes are then added with regard to the importation of slaughter cattle from adjoining territories, the export of beef, the number of prosecutions and the constitution of the professional staff for the year under consideration.

SOUTHERN RHODESIA. **Abridged Report of the Director of Agriculture for the Year 1917.**—6 pp. f'cap. 1918. Presented to the Legislative Council. (**Abridged Report of the Chief Veterinary Surgeon** [SINCLAIR (J. M.)], pp. 4–6 f'cap.)

East Coast Fever.—The incidence and methods adopted for the control of this disease in seven districts are detailed. The following general remarks are added as the result of the experience gained:—

"The number of fresh outbreaks during the year was 13, with a mortality of 43 head, as compared with 20 and 382 respectively for the previous year.

"Short interval dipping is one of the most effective methods at our disposal of dealing with Coast Fever. 'No ticks, no Coast Fever' is axiomatic, but under local conditions the former state is impossible of achievement. The complete eradication of infection is possible, however. It has been eradicated from many districts in Rhodesia and the Union, and it can be eradicated from those in which it at present exists. I have no hesitation in saying that if every area carrying infected ticks could be accurately defined the disease would be eradicated within a period of two years by our present methods. It may well be asked why these areas cannot be so defined and dealt with. The reply is, to my mind, very simple. In the majority of cases the disease has been in existence for several months (two years in the Engwa case) before it is brought to our notice. Meantime infection has been disseminated, which may and frequently does not manifest itself for another extended period, and so the cycle goes on, with the result that we are generally at the heels of the disease instead of in front of it. In dealing with the outbreaks, the known infected areas are a comparatively simple proposition; the unknown and unsuspected we cannot combat. To remedy this state of affairs universal compulsory effective dipping of cattle throughout the Territory has been proposed. Whilst the value of the proper use of the dipping tanks is fully recognised, it may be stated as a fact, and not as a matter of opinion, that weekly dipping, however effectively practised, will neither eradicate Coast Fever nor prevent its spread. It is true that as ticks are reduced in numbers by dipping the chance of the disease being propagated and disseminated is correspondingly lessened; at the same time dipping may mask infection for an indefinite period and result in recrudescences on areas where it had been regarded as a thing of the past and in fresh outbreaks on previously clean areas. This point of view is clearly and concisely expressed in the Supplementary Report of the African Coast Fever Committee as follows:—'Such dipping may prevent any noticeable number of deaths when Coast Fever exists, yet cattle moved from such areas may and have been the cause of carrying the infection with them.'"

"These remarks are not to be taken as reflecting any doubt in the writer's mind as to the value of dipping as a general prophylactic measure; they are simply intended to forestall the disappointment which is bound to result if a scheme of universal compulsory dipping at seven day intervals is relied upon for the eradication of Coast Fever.

"*Quarter-Evil.*—The mortality from this disease, which began in November, 1916, persisted throughout the year, in Matabeleland a total of 133 deaths being reported.

"*Anthrax.*—Three outbreaks occurred on farms in the Mazoe and Salisbury districts. The diseased carcases were cremated and the in-contact animals, 615 head, vaccinated. The total mortality was 9 head.

"*Tuberculosis.*—Although no case of the disease came under the observation of the Department, several head of Rhodesian cattle shewed tuberculosis lesions on *post-mortem* inspection at the Johannesburg abattoirs.

"*Contagious Abortion.*—The existence of infection was diagnosed in four herds. Unfortunately there is no satisfactory method of treatment capable of adaptation to local circumstances, but, as far as possible, infected animals are isolated, the aborted foetuses destroyed, and the farm or area involved placed in quarantine for an extended period.

"*Fluke Disease of Cattle.*—This affection appears to be increasing. During the drought a heavy mortality occurred in various districts. A few animals were treated with *Extractum liquidum filicis*, B.P., with most promising results. Owing to shortage of staff and the difficulty of obtaining this material the observations could not be carried on; they will, however, be resumed when conditions are more favourable.

"*Horse Sickness.*—The total mortality reported was 107 head, mostly horses. As most of the mules in the country and a considerable number of horses have been immunised, and as many horses possess a certain degree of resistance from several years' exposure to infection, this mortality indicates a very heavy infection during the season.

"*Sheep Diseases.*—Very few cases of blue tongue occurred and these were of a mild nature. A slight mortality, less than 3 per cent., occurred on one farm in the Melsetter district.

"*Rinderpest.*—Early in the year reports were received from Veterinary Officer Hooper-Sharpe attached to General Northey's Column in East Africa, that as a result of the many movements of cattle caused by the military operations rinderpest infection was spreading towards the border of Northern Rhodesia. Full reports of the excellent work done by this officer, under the most trying and difficult conditions, have already been submitted. The magnitude of the work of dealing with rinderpest in such a large area and the menace to the whole of South Africa by the southward spread of infection were realised by all the Administrations concerned, and Mr. C. E. Gray, Principal Veterinary Officer of the Union, was appointed Commissioner in charge of operations, and proceeded to East Africa with a staff of veterinary surgeons and complete equipment. The latest reports shew that satisfactory progress has been made in combating the disease and that there has been no further extension southward."

BRITISH GUIANA. **Report of the Department of Science and Agriculture, for the Year 1916.**—133 pp. f'cap. 1917. Georgetown, Demerara: The "Argosy" Company, Ltd. (Appendix IV. Veterinary Division [MILNE (A. Seton), Government Veterinary Surgeon], pp. 75–78 f'cap.)

The general health of stock in the Colony during the year ending 31st December 1916 is stated to have been excellent. The only outbreaks of contagious disease were of anthrax and swine fever, and these were very soon brought under control. The measures adopted for combating the small outbreaks of anthrax are indicated. No deaths among mules from anthrax have occurred for over two years, and this is attributed to the fact that imported mules are vaccinated against the disease as soon as they land in the country. In addition all the mules on the sugar estates are vaccinated once a year. Six outbreaks of anthrax involving 34 deaths occurred among cattle. No cases of swine fever have occurred for two years except on two restricted areas. No cases of glanders have occurred for three years; the disease has apparently been stamped out by the use of mallein in formerly infected centres. Cerebro-spinal meningitis which carried off a large number of mules a few years ago has not again made its appearance for over three years. Also no cases of contagious pleuro-pneumonia have occurred for 20 months. A few details regarding breeding operations with cattle, pigs, and horses are given.

A pedigree shorthorn bull affected with trypanosomiasis was successfully treated by the administration of a preparation called sodium protosanate received from the Instituto Oswaldo Cruz, Brazil. The trypanosomes were stated to resemble the causal organism of mal de caderas. The animal was badly affected at the time when the drug was injected intravenously, but the temperature dropped and the animal became almost normal in appearance within 24 hours of the first injection. Two injections were given afterwards at four days' intervals, and subsequently the animal remained in good health while under observation for a period of over 18 months. Every imported animal that had been affected with trypanosomiasis prior to this bull was lost. It is hoped that the above preparation will be successful in the treatment of mules affected with trypanosomiasis as large numbers of valuable mules succumbed to mal de caderas in 1913–1914 in the Colony.

BOOK REVIEW.

CROCKER (Walter J.) [B.S.A., V.M.D.] (Professor of Veterinary Pathology, School of Veterinary Medicine, University of Pennsylvania). **Veterinary Post-Mortem Technic.**—xiv + 233 pp. With 142 illustrations. 1918. Philadelphia & London: J. B. Lippincott Co. [Price 16*s*. net.]

This book is stated to have been written "in an endeavour to fill a gap in the American veterinary literature which has long been felt by the writer in teaching post-mortem pathology." In the opening chapter some useful information is given with regard to the precautions that should be taken prior to holding an examination in order to safeguard the operator from the legal stand-point and also against accidental infection; the regulations in force in the United States of America in connection with the forwarding of diseased specimens by post or rail are enumerated. Succeeding chapters are devoted to the structure and equipment of the post-mortem room and a description of a number of instruments said to be required for post-mortem work. After dealing briefly with the external examination of the carcase the author passes on to a minute description of the best methods for exposing all the internal organs of the horse. The internal examinations of ruminants, pigs, and the dog and cat are dealt with at somewhat less length; a few remarks on the procedure recommended in the case of the mouse, guinea-pig, rabbit, fowl, and elephant are then given. The student is next instructed in the manner of describing each organ separately after its removal from the carcase and included in this chapter are a number of useful descriptive tables of the normal organs of the various domesticated animals. The book closes with a series of specimen forms indicating briefly the manner in which post-mortem reports should be furnished.

In a subject like veterinary science, remarkable for the paucity of good text-books, especially for students, an endeavour to elucidate any branch by means of a systematic work such as the one under review cannot but be commended. The author has claim to many years' experience in teaching post-mortem pathology in one of the leading American schools and rightly regards it as a subject worthy of great consideration in the curricula of schools of veterinary medicine. Thoroughness in actual work is strongly insisted upon and with this object groups of students are told off to display all the anatomic structures of the various regions of the dead animal and report upon their macroscopic appearances. Such a painstaking procedure is no doubt much to be desired in places where proper facilities for the work exist. The extent to which the examination should be carried may be gauged from the following :—"In every autopsy one of the long bones containing yellow bone-marrow should be sawed in two parts longitudinally or split with an axe. Another should be sawed crosswise in several places." Apart from being of great value in the training of students "regular systematic post-mortems should be made and accurately recorded at every veterinary school and hospital for the accumulation of valuable data which are of great scientific and geographical interest." Also, "to avoid the oversight of some obscure though important disease process an exact and painstaking system of technic must be developed." There is no doubt but that an important disease of cattle like Johne's disease was frequently attributed by specialists to more obvious morbid processes such as parasitic gastritis until a more thorough examination of the bowel revealed the true nature of the disease. Moreover, workers dealing with certain diseases in which the lesions are ill-defined are tempted to described morbid changes such as congestion where there are no such changes, merely through lack of sufficient experience of the normal appearances of the parts in question. Many investigators in dealing with equine infectious anaemia describe characteristic lesions in the bone marrow; THEILER and his assistants in the course of systematic post-mortem work, such as is recommended by the author, in South Africa demonstrated that such changes were by no means constant in the disease and could even be seen perhaps as frequently in animals suffering from other diseases or in healthy animals. One is also struck with the ignorance often displayed by students, who have just passed through a course of anatomy, regarding the normal disposition of organs, such as the mesenteric glands in the horse and ox, that play a prominent part in several important diseased processes, although—as the author states—they "may speak most learnedly of the Malpighian corpuscles and the islands of Langerhans."

The adoption of such a thorough method of examination, although so much to be desired from the stand-point of the student or the specialist, is by no means realisable in the case of the busy practioner working under such rough conditions as are usually to be obtained in the field or in the knacker's yard. Indeed, even if he had the time it would be of doubtful advantage to him to prosecute his labours to the recommended degree of detail. Practitioners usually post-mortem animals for the most part dead of some common condition diagnosed during life as colic or pneumonia and all they require is to expose the bowels or lungs to confirm the diagnosis they had made or obtain some knowledge that would prove of value to them in further diagnosis. This practice should not be discouraged on account of lack of proper facilities. An appreciation of the proper significance of the more intricate morbid changes, however, is so much the result of prolonged training that it would perhaps be more satisfactory to them in the end if they were encouraged to forward their specimens to or consult a specialist in pathology whenever in difficulty.

The author of this book insists upon the use of a number of somewhat expensive instruments in carrying out post-mortem examinations. "One should make a practice of the constant use of these knives, and avoid the tendency to substitute a butcher knife, since systematic post-mortem work is not butchery." There are no doubt a good many people with actual practical knowledge of veterinary post-mortem work who will consider this remark somewhat irrelevant. At all events, the dexterity with which a skilled slaughterman can eviscerate and display the organs of a carcase should, at least, create some degree of envy in those who often pose as experts in pathology and yet witness a post-mortem examination quite passively with gloves and stick in hand, and fear to soil their clothes or fingers. Efficiency in the art of cutting up dead bodies, aimed at by both slaughterman and post-mortem technician, though, of course, not with the same object in view and hence not carried out on similar lines, can indeed be gauged by observing the agility with which either operator steels his butcher's knife before he touches the carcase. Both appreciate the value of a *sharp* knife in the first place, it does not so much matter about the type of knife. The skilled post-mortem operator, however, in addition requires keen eyes, sensitive fingers, and a command of language such as will enable him to describe with accuracy the manifold changes in form and appearance taken on by organs and tissues as the result of disease.

In many places it strikes one that the author is somewhat dogmatic in his directions. One is given instructions with regard to the "correct method" of exposing certain tissues and the "proper way" to hold a knife. Surely, here, the words "correct" and "proper" are not used in their strictest sense. He must mean that these particular methods were found most serviceable in his hands. The end in view in all cases would be to display organs with least disturbance to the relations of adjacent organs not yet examined and one can easily imagine that this could be attained by various individuals after some experience with equal degrees of efficiency by the employment of different methods. In this connection one is reminded of the loose way in which terms "correct" and "proper" are applied to dress and etiquette; here they certainly do not invariably imply a consummate degree of utility.

The development of skill in method or technic is largely individual or personal and thus must be left considerably to the imagination. After having obtained a good foundation in anatomical knowledge the enforcement of tedious text-book descriptions of post-mortem technic alone is not likely to create much enthusiasm in the mind of the student. One can recall the ennui felt by many students when this particular subject was dealt with in a few concise lectures. Nothing is likely to replace the energy and insistence of the teacher in the production of an absorbing interest in a subject which, to the uninitiated, is malodorous, repugnant.

As the title of the book suggests, the technic or method of exposing the organs in a dead body is primarily dealt with. Very little space is given to the interpretation of the changes observed. Where such remarks are given one finds a few vague, hesitating phrases and looks in vain for their amplification. For example, in dealing with the changes indicating the time that may have elapsed since an animal's death the author says:—"Rigor mortis begins immediately after death in some cases, and only after four to twenty-four hours in other conditions." What are those conditions? Again, he says that "the factors of description should be followed closely in dealing with the liver," and adds:—"On section a nutmeg appearance is commonly seen in degenerative processes, and in passive congestion blue blood is contained and runs from the cut surface." One would not gather from this that a passively congested liver and a nutmeg liver are synonymous terms.

The text is profusely supplemented with illustrations, most of which are quite good. Some, however, are extraordinarily crude; a cursory view of fig. 94 might lead one to mistake it for a reproduction of some weird mountain scenery if the legend underneath had not acquainted one with the true fact, namely that it was the head and neck of an ox with the skin of the right side removed.

The book is well printed on good paper and the publisher's work throughout has been well done.

J. T. E.

TROPICAL DISEASES BUREAU.

TROPICAL VETERINARY BULLETIN.

Vol. 6.] 1918. [No. 4.

DISEASES DUE TO PROTOZOAN PARASITES.

Rosenthal (F.). **Beiträge zur Immunität bei Trypanosomeninfektionen. Ueber den Mechanismus der chemotherapeutischen Heilung.** [Immunity in Trypanosomiasis. The Mechanism of Chemotherapeutic Action.]—*Ztschr. f. Immunitatsf. u. experim. Therap.* I. Teil. Orig. 1918. July 20. Vol. 27. No. 4. pp. 287–304. With 4 tables.

The curative effect of a drug does not depend entirely upon its affinity for the parasite cells but also upon the complex relationships existing between it and the host's body. To commence with, one endeavours to ascertain the sensitiveness of the body cells of the host towards the activity of the drug and the toxic effect of this substance upon the infective organisms. The chemotherapeutic effect of the drug would correspond with the degree to which the parasite-destroying properties of the drug exceeds its organ-destroying property. This biological formula, as laid down by Ehrlich, does not, however, furnish an exhaustive explanation of all the complex phenomena of chemotherapy. Morgenroth and Halberstädter showed that this view only took into account the combinative powers of the cells for the poison and not their sensitiveness and no light was given on the distribution of the chemotherapeutic action by chemical tests; moreover, no account is taken of the rate of absorption and elimination of the drug. As a rule the longer the product remains at its optimum concentration in the circulation and tissue juices the greater will be its effect upon the infecting organisms.

The therapeutic effects brought about by the injection of the drug are also not exhausted by simple destruction of the parasites. As in the case of vaccination with dead or attenuated viruses the production of specific protective bodies is brought about. The role of these substances in the recovery of the affected animal was demonstrated in Ehrlich's original researches; this author pointed out that the curative effect of a drug became accomplished through the simultaneous action of specific trypanocidal antibodies. The presence of these bodies can be demonstrated in trypanosome-infected mice within two or three days after the administration of a curative dose of a drug, although their concurrence in the curative action resulting from the injection of the drug is not demonstrable from this observation. SCHILLING also found reason to believe that the trypanocidal antibodies made their appearance within a very short time after the injection of the medicament; for example, nagana-infected rats treated with a curative dose of arsenophenylglycine showed immunity against super-infection in 24 hours, and further a nagana-infected rabbit even proved immune within three hours after intravenous injection of the same drug (SCHILLING and JAFFE). The prolonged prophylactic action of arsenophenyl glycine cannot, however, be excluded with certainty in making deductions from these results. In all experiments hitherto performed it is thus seen that the time of onset of immune bodies in the circulation has been insufficiently determined.

The experiments performed by the author were carried out with the object of determining whether the specific trypanocidal substances followed rapidly after the commencement of the chemotherapeutic action or made their appearance after the pharmacological action had come to an end, i.e., whether there existed a latent phase separating the formation of antibodies from the period of drug action or whether these antibodies exercised an appreciable effect in the process of recovery towards the later stage in the action of the drug.

In the experiments performed with this object in view the author employed trypanosome-infected mice which were given subcutaneously a curative dose of tartar emetic at the height of infection and then at various intervals injected intravenously with a rich emulsion of living trypanosomes. The author and MORGENROTH had previously shown that tartar emetic was capable of causing the disappearance of trypanosomes from the blood within three hours after injection and that the protective effect of this injection against subsequent severe intravenous infection was just appreciable after ten minutes, hardly appreciable after one hour, and altogether absent within two to three hours after administration of the medicament. This drug was thus much more suitable for the experiments than such products as arsacetin and arsenophenylglycine. Further experiments were made in which it was proved that although tartar emetic exercised such powerful curative effects it had scarcely any appreciable prophylactic action and, finally, the effects of neutralising the action of tartar emetic within the body by administering intravenously its antidote, potassium hexatantalate, simultaneously and also at intervals of a few minutes were tested.

Briefly the author's conclusions are as follows:—

"Trypanocidal immune bodies make their appearance even within the first hour of the commencement of the chemotherapeutic treatment and take an immediate active part in the recovery. Their early appearance is manifested:

"(1) Directly: by the method of early intravenous infection of newly recovered trypanosome-infected mice. The utility of the method obviously depends upon the employment of a chemotherapeutic agent which exhibits a markedly transitory prophylactic action such as, for example, tartar emetic.

"(2) Indirectly: (a) by the paradoxial divergence in the chemotherapeutic action of tartar emetic in prophylactic and curative tests;

"(b) by the uninterrupted recovery in cases of trypanosomiasis treated by means of tartar emetic even when the antimony action is eliminated at an early stage through the action of potassium hexatantalate."

PEARCE (Louise) & BROWN (Wade H.). **Experimental Trypanosomiasis. Its Application in Chemotherapeutic Investigations.**—*Jl. Experim. Med.* 1918. Aug. 1. Vol. 28. No. 2. pp. 109–147. With 8 tables and 13 plates, comprising 30 figs.

In this article the authors state that "although experimental trypanosomiasis has been the subject of countless contributions to the literature, comparatively little has been written, regarding the biological principles involved in the adaptation of the experimental infection to chemotherapeutic investigations." A brief account of the history of the drug treatment of experimental trypanosomiasis by various workers is given. In these investigations mice appear to have been more extensively used than any other animals and the infecting organism most commonly employed has been *Trypanosoma brucei.* Next in frequency have come rats, while rabbits, guinea-pigs, and other animals have been used in small numbers and largely to supplement rat and other experiments. The methods hitherto adopted appear to the authors to lack co-ordination. The essential requirements of workers are a means of determining quickly and accurately the activity of substances upon an infecting organism and a means of determining the curative powers of these substances, which may be problems of an entirely different character. The solution of these problems can best be approached through a careful analysis of the various forms of trypanosomiases, including both the animals and organisms utilised, the means of propagating and regulating the infection, and finally, the general response of various species of trypanosomes to therapeutic agents.

The methods of propagating laboratory strains of trypanosomes in experimentally infected animals are next indicated. Continuous direct passage from animal to animal of the same species is desirable in order to obtain uniformity of infection reactions where the organisms are to be used for therapeutic experiments. Blood from animals at the height of infection is diluted with an isotonic salt solution so that a certain volume used for inoculation always contains approximately the same number of active trypanosomes. In their laboratory the authors inoculated mice, rats, and guinea-pigs intraperitoneally with a comparatively small number of *T. brucei*, *equiperdum*, and *evansi* and about double that number of *T. gambiense* and *equinum*. Rabbits were infected intravenously also with a small quantity of the first named three trypanosomes and a much larger quantity of the other two strains. Mice or rats to be used for therapeutic experiments are inoculated from a stock strain carried in mice or rats, while guinea-pigs and rabbits may be inoculated from a guinea-pig stock; the transmission of the trypanosomes is carried out in this way on account of the fact that the organisms bring about a rapidly fatal termination in the case of mice and rats while guinea-pigs and rabbits exhibit a chronic cyclic infection.

The authors then detail at some length their clinical and post mortem observations in connection with the transmission of the above-named five strains through the ordinary laboratory animals. In the tables are summarily indicated the hitherto published results of other investigators. The clinical study then given at some length by Pearce and Brown does not add very materially to the already existing knowledge on this subject. After discussing the principles of adaptation and utilisation of the various strains of trypanosomes and laboratory animals for chemotherapeutic investigations they conclude their paper as follows :—

> "Treatment of experimental trypanosomiasis of mice and rats is largely a matter of speed and action. Since these animals are easily procurable and the results of treatment are quickly seen, the chemotherapist has in this type of infection a valuable experimental test for the quick determination of the therapeutic activity of a compound. For all preliminary routine work, especially if a large number of compounds are to be tested, the utilization of mouse and rat infections gives definite and valuable information in a relatively short space of time. On the other hand, since experimental trypanosomiasis of guinea-pigs and rabbits is predominantly a chronic tissue infection more nearly analogous to the naturally acquired forms of the disease, the factor of ultimate curative power or potency of a compound, rather than its immediate trypanocidal action, is emphasized in the treatment of such infections. From the point of view of the chemotherapist, the two types of infections supplement each other and the proper utilization and adaptation of each type constitute a logical basis for procedure in the chemotherapy of experimental trypanosomiasis."

CITRON (H.). **Ueber die Einwirkung des Mesothoriums auf Trypanosomen.** [The Action of Mesothorium on Trypanosomes.]—*Ztschr. f. Immunitatsf. u. Experim. Therap.* I. Orig. 1918. Aug. 17. Vol. 27. No. 5. pp. 369–373.

No sterilisation is produced by submitting trypanosomes to the action of γ-rays, even for several hours; the only change brought about in the organisms is to cause them to set up an infection of lessened severity in inoculated animals, with the ultimate result that such animals succumb later than controls. The substance necessary for prolonging the viability of the trypanosomes passes easily through a dialyser.

HARTMANN (M.) & NOELLER (W.). **Untersuchungen über die Cytologie von *Trypanosoma theileri*.** [Investigations on the Cytology of *Trypanosoma theileri*.]—*Arch. f. Protistenk.* 1918. Apr. 27. Vol. 38. No. 3. pp. 355–375. With 2 plates & 6 figs.

In this article the authors take the non-pathogenic cattle trypanosome, *T. theileri*, for their studies in connection with the morphology and method of division of the various structures composing a trypanosome cell, on account of its comparatively large size and the ease with which it can be cultivated on laboratory media [see this *Bulletin*, 1917, Vol. 5, No. 3, pp. 166–171]. A comparison is made with the processes occurring in *T. noctuae, lewisi, brucei, dimorphon,* and *Schizotrypanum cruzi.* The article is illustrated with a number of beautiful figures. The authors' conclusions to a somewhat highly technical discussion are as follows :—In *T. theileri* the blepharoplast and basal granule divide separately and the old flagellum remains connected with one of the daughter basal granules whilst from the other basal granule a new flagellum is formed.

WOODS (Alan C.) & DE SCHWEINITZ (George E.). **Trypanosome Keratitis —An Experimental Study.**—*Arch. of Ophthal.*, New Rochelle. 1917. Sept. Vol. 46. No. 5. pp. 431–445. With 1 plate.

The authors first give an interesting summary of previous work done in connection with the nature of the ocular changes in trypanosomiasis. There appears to be some dispute as to whether the keratitis is produced by the presence of the trypanosomes themselves or by the action of the toxin secreted by these organisms remote from the seat of injury. In the observations recorded in this paper dogs infected intravenously with *T. equiperdum* were used. The following is the authors' summary :—

> " Ocular lesions occur constantly in dogs infected with the Trypanosoma equiperdum. These lesions are manifested clinically as a dense clouding of the cornea and an iritis with hemorrhages and exudates in the anterior chamber, with the occurrence of pericorneal injection and photophobia. The lesions are not caused by a general toxaemia, but occur synchronously with an actual invasion of the ocular humors by the trypanosome, and appear to be dependent upon the invasion of the ocular humors and the ocular tissues by the parasites. The ocular lesions are readily cured by repeated injections of arsenobenzol, the American reproduction of salvarsan.
>
> " Pathologically, the corneal lesions are those of an interstitial keratitis with an actual invasion of the substantia propria by the trypanosomes. The lesions of the iris consist in a marked oedema of that tissue, with a rather dense cellular infiltration of mononuclear and polynuclear cells. The ciliary processes are themselves uninvolved, but occasionally they are embedded in a serofibrinous cellular exudate in which occasional trypanosomes are found. The retinal lesions consist of focal lesions characterized by a disarrangement of the retinal layers with a monocellular infiltration. Over these areas is a cellular exudate containing trypanosomes."

BLUMENTHAL (Franz). **Ueber die Wirkung von Rontgenstrahlen auf** *Trypanosoma Brucei.* [On the Action of Rontgen Rays on *T. brucei.*]—*Berlin. Klin. Woch.* 1917. Sept. 17. Vol. 54. No. 38. pp. 918–920.

In the first part of his paper the author deals with the literature on the above subject and then records his own experiments in which mice infected with *T. brucei* were submitted to the action of Rontgen rays. It was found that no noteworthy effect was produced upon the organisms in the living animal. As the result of enormous doses of the rays, however, there was a delay in the development of the infection, but in such cases the injury to the body of the host was so great that the mouse often died before trypanosomes could be observed in the blood. If the animal survived the first few days, however, trypanosomes appeared in the blood. The delay in the appearance of the organisms was more probably due to the severe blood changes caused by the action of the rays than to direct action upon the parasites. Experiments with suspensions of living trypanosomes diluted in normal saline solution *in vitro* also failed to demonstrate any noteworthy changes as the result of the action of the rays.

STEVENSON (A. C.). **The Presence of Trypanosomes in Brain Substance. Preliminary Note.**—*Jl. Trop. Med. & Hyg.* 1918. Jan. 15. Vol. 21. No. 2. p. 17. With 1 plate comprising 6 figs.

In this short note the author describes the occurrence of trypanosomes in the brain substance of a guinea-pig inoculated six months previously with a strain of *T. nigeriense.* After about five and a half months from the time of inoculation the guinea-pig showed some weakness of the hind quarters which became more definite during the succeeding two weeks. Paraffin sections of the brain showed trypanosomes, many of which were dividing, scattered through all parts of the brain substance, with no special relation to the capillaries and small blood vessels. The organisms appeared to be most numerous in the mid-brain. The small-celled infiltration of the perivascular tissue, the presence of which is characteristic in human sleeping sickness, was well marked, and masses of trypanosomes were seen in the affected parts.

Another guinea-pig inoculated from the above survived only four months, dying suddenly without symptoms; sections of the brain showed a large number of trypanosomes in the blood vessels, but in the brain substance itself they were only found after prolonged search near the surface of the cerebral hemispheres. No perivascular infiltration was observed in the substance of the brain but a small amount was seen around the vessels of the pia mater. In the medulla below the floor of the fourth ventricle there were numerous capillary haemorrhages which contained numbers of trypanosomes. No Gram-staining streptococci were found in these brains as are often found in sleeping sickness brains.

The presence of trypanosomes in the brain substance itself appears to have been described only in one instance, viz., by WOLBACH and BINGER (1912) in the brain of a monkey.

VELU. **Une trypanosomiase du cheval au Maroc. Etude clinique et Expérimentale.** [A Trypanosomiasis of the Horse in Morocco. A Clinical and Experimental Study.]—*Rev. Gén. Méd. Vét.* 1918. Oct. 15. Vol. 27. No. 322. pp. 489–513.

From August 1916 to August 1917 Velu studied among the horses of a native cavalry unit at Dar-bel-hamri a trypanosomiasis transmitted probably by the bites of gadflies; it also presented special features in that it ran a characteristic clinical course, developed differently from other trypanosomiases in laboratory animals, and its causal organism was a dimorphic trypanosome. On this account the author proposes the name "Trypanosomiasis of Moroccan Horses" for the malady.

The course of the outbreak since it was first diagnosed in 1914 is outlined. During the year June 1916–1917 out of a total of 178 horses 125 had become infected, out of which 86 died. The remaining 39 sick animals had then apparently recovered and were distributed to various units.

Clinical study.—The natives believe that the disease is caused by the bites of tabanids (*el debab*), which are found in abundance in this region especially around shrubby outgrowths and bite horses during the hottest part of the day; horses are difficult to breed in this district. Inasmuch as only the more severe symptoms attract attention they believe that the disease lasts only about a week. The more chronic forms accompanied by anaemia are regarded as a different disease, *el roch*, meaning cachexia.

The period of incubation of the natural disease is difficult to determine. From observations on 12 horses the maximum duration was estimated to vary from 59 to 104 days.

The symptoms at first are ill-defined and escape attention if the animal is not closely observed. Soon afterwards the animals become dull and dejected-looking; the appetite is maintained but irregular. The animals sweat easily and become rapidly exhausted and are unable to keep up with other horses on the march. Recurrent febrile attacks are very characteristic and between these attacks the infected animal may appear quite normal. At a more advanced stage of the disease anaemia and cachexia, however, attract attention.

Each febrile attack is manifested externally by dullness, more or less intense dyspnoea, haggard appearance, petechiae, inco-ordination of movements, inappetence and fever. The first distinct febrile attacks are sometimes separated by considerable intervals—up to three months in one observation—and the affected animals might during that time be wrongly considered free from the disease. As a rule these crises are more frequent and more regular during periods of intense heat and rarer during rainy weather. The average interval between two consecutive crises varies. As a rule the temperature rises to 104·9°–105·8° F., exceptionally to 107·2° F., and the fever remains for four or five days, exceptionally up to eight days. In some cases the temperature falls within a few hours. The rise and fall of the temperature curve is very irregular, and considerable differences may be exhibited between the morning and evening temperatures, 5° F. or more. At the commencement of the disease the febrile crises are often of very short duration. In rare cases they are non-existent and the fever is more or less continuous, especially in those cases where the disease runs its course very quickly.

Stupefaction is a constant symptom during the crises; the affected animals allow themselves to become covered with flies; the muscles supporting the head and tail are relaxed.

The next sign of most constant occurrence is in connection with the locomotor system. The animal drags its hoofs on trotting, and shows unsteady gait; paresis or even paraplegia of the fore limbs may set in or even complete inco-ordination of movements; when these symptoms are acute incontinence of the urine is also observed.

Ocular symptoms are fairly constant; the conjunctiva is generally brownish in colour, sometimes distinctly jaundiced, indicating gastro-intestinal derangement. The brownish colour is sometimes masked by congestion and the conjunctiva is covered with more or less large petechiae, which are at first of a light red and finally of a dark violet colour. The eyelids are slightly oedematous. The upper layers of the conjunctiva sometimes become shed and the erosions thus produced sometimes set up a marked conjunctivitis manifested by considerable lachrymation. In very acute cases the changes in the eye may be more intense and hence the animal may shed blood-stained tears. In rare cases keratitis may be seen.

In the majority of cases there are no subcutaneous oedematous swellings in this disease. If they are present they are small, sharply circumscribed and situated especially around the fetlocks.

Cardiac symptoms are also noted; the pulse is small, rapid, thready; the heart palpitates on the slightest exertion; a very marked venous pulse is very often observable. An exudation into the pericardial sac takes place concurrently with the ocular lesions and oedematous swellings. The blood becomes watery and assumes a characteristic colour resembling "*sirop de grenadine.*"

With regard to the evolution of the disease it is stated that it often develops as a chronic progressive anaemia with intermittent febrile crises; wasting is more or less marked. If the animals are well looked after at the commencement of the disease they may present a normal appearance, but they are found to be easily exhausted on being put to work. Finally, after a number of attacks anaemia, marked cachexia and inco-ordination of movements set in just before death. The above symptoms become more and more intense during the final crises. In a small minority of cases death occurs rapidly, after a few weeks, during an acute febrile attack.

It is difficult to determine the duration of the disease; symptoms were found to persist in one animal over a whole year. The question as to whether there are any spontaneous recoveries remains unsolved.

The lesions found on post-mortem examination vary according to the type of the disease. In the chronic forms there are no characteristic lesions except those of a more or less marked anaemia. In the acute form one may observe a serous infiltration of the subcutaneous connective tissue, haemorrhages on the serous membranes and on the epicardium, and fairly abundant serous exudate in the pericardial sac (up to four litres). The heart is often hypertrophied, the liver is normal, the kidneys congested, and the spleen always enlarged.

Experimental Study.—The causal organism is a trypanosome, which is dimorphic in the horse and certain experimental animals (dog, rabbit) and monomorphic in the rat. It occurs either as somewhat long forms with free flagella or as shorter stumpy forms without free flagella or with a flagellum less than $2{\cdot}5\mu$ long along its free part; the latter forms are much less numerous than the forms with free flagella (less than 10 per cent. in the horse, somewhat more numerous in the dog). Complete details with regard to the dimensions of the trypanosome are not given in this paper. The trypanosomes are somewhat rare throughout the whole course of the disease. As in the disease known as *souma* they are only found in the peripheral blood at the commencement of the disease and during the febrile crises; but even during these crises their presence is by no means constant. Later on in the course of the disease they are impossible to detect even after careful search. In the chronic forms they re-appear towards the termination of the disease and are then very numerous during febrile attacks. A certain diagnosis based on simple examination of the blood even after centrifugation is thus very difficult, if not impossible, and one must resort to test inoculations. The inoculation of 5 or even 10 c.c. of blood into a susceptible animal often gives negative results and thus it is advisable to inject 50 to 80 c.c. of blood or other fluid from the diseased animal.

With regard to the virulence of the organism for various experimental animals the author's investigations gave the following results:—The trypanosome was found to be very virulent for the white rat, which after a period of incubation of about three or four days presented a severe type of infection lasting on an average from seven to ten days. On post-mortem examination the spleen was found to be enormously enlarged.

The rabbit was only slightly susceptible. The disease took on a chronic form with a slow and irregular course. The symptoms and lesions were similar to those of all the other kinds of trypanosomiasis in this animal.

In the dog the disease ran a sub-acute course with frequently occurring crises. The presence of the trypanosome almost constantly in the blood of this animal subsequent to inoculation makes it very useful for test inoculations.

In the case of two mules the disease ran a relatively rapid course compared with that of the natural affection.

Clinically this trypanosomiasis of Moroccan horses appears to be a distinct morbid entity. However, it presents certain resemblances with *mbori* which, however, is characterised by severe locomotor changes and with *souma*, which runs a more rapid course, and, finally, with *debab* of the camel. SERGENT showed that the trypanosome of this disease isolated by BELLEVAL was different from that of *debab*. LAVERAN also showed that the trypanosome isolated by DELANOË and FIORI from horses at Mazagan differed from the *debab* organism. BOUIN's experiments at Marrakech appear to show that the organism of the Moroccan *debab* was less virulent than the equine trypanosome.

The author then proceeds to deal with the invariably unsuccessful attempts made at curative treatment by means of various medicaments comprising arsenic and antimony compounds; these results were summarised in the preceding number of this *Bulletin* [see p. 151]. [A M.S. report giving fuller details of these experiments has just been received.] The article ends with a discussion on the prophylaxis of the disease based on the isolation or slaughter of affected animals, and avoiding areas infested by tabanids.

DI DOMIZIO (Giovanni). **Una tripanosomiasi del dromedario eritreo (Gudhò). Cenni sulle mosche ematofage della Colonia Eritrea.** [A Trypanosomiasis (*Gudhò*) of Eritrean Dromedaries. Notes on Blood-sucking Flies of the Colony of Eritrea.]—*Clinica Vet.* 1918. Aug. 31–Sept. 15. No. 16 & 17. pp. 391–413. With 3 text figs. and 1 plate comprising 11 figs.

Trypanosome diseases in Eritrean dromedaries were first noted by MEMMO, MARTOGLIO and ADANI (1905). In 1912 PRICOLO described a severe infection lasting usually only 24 to 48 hours in dromedaries imported into Libya from Eritrea; a trypanosome 22–30μ long by 4μ broad was discoverable in the blood of these animals. In 1913 MARTOGLIO identified two kinds of trypanosomiasis in the dromedaries of Eritrea, viz., one caused by a trypanosome identical with that occurring in the bovines of the country and known as *giahan* by the natives, and the other known as *atteh*, the trypanosome of which was referred to as a variety of the surra organism. The first accounts of *giahan* were given by MEMMO, MARTOGLIO and ADANI. These authors stated that a trypanosomiasis occurred among bovines along the coast and in the lower regions of the Sahel district. Goats and Abyssinian sheep were susceptible to infection by this bovine organism. Horses and donkeys were less susceptible. Rats, dogs, and monkeys appeared to be immune. The trypanosome had the following dimensions,— young forms 14–16μ, adult form 24μ. An important point in the morphology of this organism was that the centrosome was situated at the extreme posterior end and in a few specimens it appeared to be constituted of a minute mass of chromatin.

In his work published in 1913 MARTOGLIO maintained that this affection known as *giahan* occurred naturally also in dromedaries under the native term *gudhò*, meaning decline or misery. The so-called *gudhò* of dromedaries and *giahan* of bovines, moreover, presented the same clinical course, symptomatology, severity, and geographical distribution. But, in a certain percentage of the cases the disease ran an acute course with death occurring in a few weeks, while the remaining cases were of a more chronic character and lasted from two to three months. Among the animals that survived longest there were a certain number of recoveries. The symptoms were oedematous swellings, nervous twitchings, inco-ordination of movement in the hind quarters and, in the case of horses, attacks of paresis. An important biological property of the *giahan* trypanosome was that it was not pathogenic for dogs, rabbits, rats and mice; if the very young animals of these species were inoculated the trypanosomes might propagate for a time but they remained saprophytic and then disappeared completely. These trypanosomiases (*giahan* and *gudhò*) were said to be transmitted by Stomoxydae. According to SERGENT (1914) MARTOGLIO undoubtedly was working with *Trypanosoma cazalboui*.

The other trypanosomiasis of dromedaries known as *atteh* and transmitted, according to MARTOGLIO, by Tabanidae (Haematopota, Pangonia) ran a very chronic course lasting from one to two or more years, wasting and anaemia being the more important symptoms, with a much lower mortality than in the last named affection and probably immunity was subsequently produced. The trypanosome measured about 30μ long (without flagellum which was 8μ long) by 3 to 4μ broad at the level of the nucleus. The centrosome was 3 to 5μ from the posterior extremity, which was generally moderately drawn out and blunted. It differed also from the *giahan* trypanosome inasmuch as it set up a chronic disease in horses and sheep terminating, as a rule, in recovery; it was not pathogenic for cattle although these animals might harbour the parasite in a latent state and their blood prove infective for dogs in from four to five months after infection. It was highly pathogenic for dogs, rabbits, mice, and rats. MARTOGLIO believed that the *atteh* trypanosome was a variety of the surra trypanosome, analogous to that of *mbori*.

PRICOLO and FERRARO (1914) in describing a trypanosomiasis of camels in Tripoli believed that this affection was introduced with imported Eritrean dromedaries and described a trypanosome which was stated to be identical with *T. soudanense*, the causal organism of *el debab*.

The author then goes on to describe at considerable length his own observations on *gudhò*. This disease occurs in all the low-lying and moderately elevated districts in Eritrea with the exception of the pastures lying immediately adjacent to the Red Sea. The losses are greatest on the mountain slopes facing the Red Sea where blood-sucking flies are most numerous. In the western part of the Colony losses are rare. The incubation period is long (from three to four months) and the first symptoms are a gradual loss of condition, intermittent slight fever, and more or less abundant lachrymation without ocular lesions; the appetite is generally maintained up to the end. Sometimes diarrhoea may set in before death. There are no appreciable oedematous swellings, the excretory system seems to be unaffected. Observations show that the disease might last from five or six months up to two years. The termination is usually fatal and death occurs owing to extreme debility. Recovery when it takes place is always preceded by a long convalescence and appears to be followed by a lasting immunity. The disease shows no great tendency to spread and this appears to be due to the fact that camel-men take care to avoid the zones infested with blood-sucking flies. There is no noteworthy post-mortem lesion.

The author dwells at length on the distribution of the various blood-sucking flies in the affected districts. A list of the species has already been given in this *Bulletin* [Ferraro, Vol. 5, No. 4, p. 253]. It appears that all these species are capable of transmitting the disease mechanically but the most deadly localities for dromedaries are not those infested with Stomoxydae but those containing Pangonia and Tabanidae. The last-named, known as the *aur*, are particularly feared by camel-men.

The trypanosome of *gudhò* when examined in the fresh state shows fairly active translatory movements. At the commencement of the disease and for a short time afterwards the trypanosomes are found abundantly in the blood (5 or 6 per field of the microscope, objective 1/15, ocular 6, Koristka) but the numbers may show considerable variations when blood is examined at different times. Subsequently the trypanosomes become rarer and disappear for more or less prolonged intervals. Their reappearance is generally marked by a febrile attack. In preparations stained with Giemsa the trypanosomes appear slender with numerous folds in the undulating membrane and a moderately long free flagellum showing usually two or three spirals. The dimensions varied from 18–26μ in length including free flagellum by from 1½ to 2μ broad at the level of the nucleus. The predominant forms measured from 22 to 25μ. Forms 22μ in length were less numerous while those 18μ long were rare. The breadth did not seem to be in direct proportion to the length, forms 25 to 26μ long by 1 to 1½μ broad and forms 18 to 20 by 2μ being observable. Forms about to undergo division might measure 2 to 2½μ broad by 28 to 30μ in length. Very rarely stumpy forms of medium length and about 4μ broad could be seen. The centrosome, which was rounded and distinct, was usually situated about 2μ from the posterior extremity, which was tapering, slightly rounded, rarely markedly blunted. The flagellum was well developed along its whole course. The nucleus was oval, 2 to 3μ long by 1 to 2μ broad. The cytoplasm sometimes contained minute chromatin granules around the centrosome and nucleus.

A more or less marked leucocytosis with an appreciable increase in the large and small mononuclears and also changes in the red corpuscles could be seen in the blood of affected animals.

The author next deals with the identification of this trypanosome and points out that it shows fairly distinct morphological differences from that of *giahan*, besides being somewhat smaller and provided with a more distinct undulating membrane. The centrosome is situated at a distance of $1\frac{1}{2}$ to 2 to 3μ from the posterior end while that of *giahan* (*T. cazalboui* according to LAVERAN and SERGENT) possesses a terminal or almost terminal centrosome. He further points out that the symptomatology of *gudhò* differs in many respects from that of *giahan*, the incubation period is longer, and the disease runs a more protracted course without showing neuromotor changes as in the case of *giahan*. The *gudhò* trypanosome is infective for dogs. Although no attempt at experimental transmission to cattle was made there is every reason to believe that the *gudhò* trypanosome is not infective for these animals under natural circumstances, inasmuch as cattle remained unaffected in localities where the blood-sucking flies suspected to transmit *gudhò* were very prevalent. No trypanosome was visible in the blood of a large number of such bovines although dromedaries undoubtedly infected had passed through the district. The immunity of the native cattle towards the trypanosome was also proved by PRICOLO and FERRARO. It is possible that the bovines may act as carriers of the *gudhò* trypanosome and on the other hand that dromedaries may harbour the *giahan* trypanosome in a latent and inoffensive state. After some further discussion on the identity of the trypanosome the author concludes as follows:—

> "There exists in the Colony of Eritrea a trypanosomiasis of dromedaries called *gudhò* by the natives, which is transmitted by Tabanidae, at least, most commonly, and probably also by Stomoxydae and Lyperosia.
>
> "The causal organism of *gudhò* in dromedaries can be differentiated morphologically and biologically from that of *giahan* in bovines. It is by no means probable that it can be identified with that of *atteh*, the other trypanosomiasis in Eritrean dromedaries.
>
> "The morphology of the parasite, the clinical aspect of the disease set up by it, its mode of transmission (by tabanids), and its geographical distribution cause one to believe that the *gudhò* trypanosome is identical with *T. soudanense* of camels along the Mediterranean Coast of Northern Africa, while that of *atteh* should probably be designated as a variety of *T. evansi* in the same way as that of *mbori*. The question requires further investigation."

MITZMAIN (M. Bruin). **The Rôle of *Stomoxys calcitrans* in the Transmission of *Trypanosoma evansi*.**—*Philippine Islands, Bureau of Agric.* Bull. No. 24. pp. 51. With 5 plates & 17 tables. 1913. Manila: Bureau of Printing.

In this tardily received paper an account is given of a large number of carefully performed experiments carried out by the author in the Philippine Islands with the object of ascertaining the rôle of the common horse biting fly in the transmission of the surra trypanosome. An extract of a paper by this author entitled "Collected Studies on the Insect Transmission of *Trypanosoma evansi*" has already appeared in this *Bulletin* [Vol. 5, No. 1, pp. 10–14]. In that paper it was stated that the evidence was strongly in favour of the gadfly *Tabanus striatus* Fab. acting as the transmitter, by mechanical means, of the trypanosome in the Philippines. Experiments were also described to ascertain the rôle of mosquitoes, *Lyperosia exigua*, *Philaematomyia crassirostris*, *Hippobosca maculata*, blood-sucking gnats, and the common house fly *Musca domestica* in the transmission of surra; the results were negative, but the common house-fly was found capable of playing an indirect part in transmission. As in the preceding paper an interesting summary of the literature on the subject is given in this paper. The author's general summary is as follows:—

"1. Only negative results were obtained in the attempts at direct mechanical transmission of surra with flies which were induced to bite healthy animals at intervals ranging from five minutes to three days after being permitted to complete the feeding upon infected animals. Thousands of *Stomoxys calcitrans* were employed in 29 experiments involving the use of 3 horses, 6 monkeys, and 22 guinea pigs.

"2. Twenty-seven experiments were performed in attempts to transmit surra by the interrupted method of feeding. All attempts proved negative *where a single application of a varying number of flies was used*, as many as 38 on a horse, and a maximum of 40 on a small guinea-pig. The intervals between feeding on infected and healthy animals averaged twenty-five to forty seconds in the two instances cited.

"3. In 3 trials, interrupted feeding was employed in successive daily applications. In attempting to determine the minimum number of bites necessary to infect an animal, as high as 40 were followed by negative results. The only positive result obtained was produced from a succession of 206 interrupted bites in which the flies were transferred immediately from the infected to the clean animal. The flies were applied thirty-two hours during a period of six days.

"4. The results of these experiments indicate that *Trypanosoma evansi* does not develop in the body of *Stomoxys calcitrans*. Ninety-four days was the longest period in which laboratory-bred flies were tested for a cyclical development, and sixty-seven days the maximum for wild flies.

"5. Organisms of surra were not found in *Stomoxys calcitrans* beyond eighteen hours after feeding on an infected animal, and the limit for infection by inoculation was ascertained in these experiments to be six hours.

"6. Pathogenic trypanosomes were found in the proboscis of the fly thirty seconds after feeding on infected blood. Within one minute and thirty seconds the organisms were not present in the mouth parts in a form capable of infecting by inoculation into guinea-pigs.

"7. The wounds made by the labium of *Stomoxys* were not found to be a suitable channel for infection. Consequently it is not likely that surra in domestic animals is produced through this avenue by external contamination; namely, faeces, mouth parts, and pulvilli of infected flies.

"8. The intimate relation in the feeding habits of *Stomoxys* and of house flies has been pointed out. *Stomoxys* has been demonstrated to provide through its bites the infection of *Musca domestica* and other dung flies. These flies have been demonstrated to act as carriers, harbouring the surra organisms for several hours.

"9. No evidence was obtained to indicate that *Tr. evansi* is hereditarily transmitted to the offspring of *S. calcitrans*. The larva of this fly fed on surra blood does not continue to harbor the trypanosome and the fly is 'clean' upon reaching maturity.

"10. It is demonstrated that the individual glass-tube method is the most suitable for applying flies in feeding on experimental animals and for keeping flies for long periods under laboratory conditions."

GALLI-VALERIO (B.) & STALDER (H.). **La piroplasmiase des bovidés en Suisse.** [Bovine Piroplasmosis in Switzerland.]—*Schweiz. Arch. f. Tierheilk.* 1918. Oct. Vol. 60. No. 10. pp. 471–477. With 1 fig.

This article apparently refers to the first authenticated cases of bovine piroplasmosis in Switzerland. Since 1912 Stalder has observed a few cases of acute anaemia accompanied by severe haemoglobinuria among the milch cows of the Cossinay districts. The symptoms became aggravated to such an extent that the animals were slaughtered in from three to four days after the onset of symptoms and on post-mortem examination dropsy, fatty degeneration of the liver and increased size and diffluent consistency of the spleen were very noticeable. Medicinal treatment produced no effect.

The symptoms and lesions described resembled so closely those of piroplasmosis, the presence of which in Switzerland had been suspected by GALLI-VALERIO for a long time, that a microscopic examination of the blood was made. After staining with Giemsa it was found that several abnormally large red corpuscles contained basophilic granules; the corpuscles invaded with piroplasms were somewhat rare. The most common forms of the parasite were pear-shaped forms occurring more often singly than in pairs within each corpuscle. They were stained of a light blue colour, especially towards their margins, with clear spaces within their thicker parts. One or more red stained chromatin granules were observable particularly towards the thinner ends or on the borders. The pear-shaped forms were from 3 to 4 by 1 to 1·5μ in dimensions. The larger isolated forms were of most common occurrence. In some corpuscles ovoid or almost spherical forms with fragmented chromatin could be seen. A few free-lying piriform bodies were also noted. The parasites were extremely rare in the liver and kidneys but more easily found in the spleen. In some of the red corpuscles there were up to three pear-shaped forms arranged in fan-shaped fashion. Many of the forms seen in the spleen were extra-corpuscular on account of the marked destruction of the blood corpuscles.

The question arises as to whether the species of piroplasm encountered by the authors belonged to *P. bigeminum* Smith and Kilborne, or *P. divergens* McFadyean and Stockman. The former species is held to be the cause of bovine redwater in tropical countries and the second in Europe. These species have been differentiated not only on account of their morphological appearances and minor differences in dimensions but also principally on account of the fact that they are incapable of setting up reciprocal immunity. The authors state that if these two organisms are really distinct species it is highly probable that the form observed by them was *P. divergens*. The occurrence of piroplasms singly within the corpuscles has been noted several times by LIGNIÈRES (1900) in Argentina and the very large piriform bodies may be observed also according to NUTTALL in the case of *P. divergens*. [The figures presented by the authors do not enable one to form an opinion as to which species of parasite they really represent. None of the figures represent a pair of parasites within a single corpuscle.—ED.] The fact that the parasites may sometimes be very rare even in acute cases has been pointed out by LIGNIÈRES. This fact probably explains why it has been very difficult to demonstrate the existence of bovine piroplasmosis in many localities.

It is stated that bovine piroplasmosis thus occurs in Switzerland in centres which may from time to time present cases of acute infection. These centres may prove of great danger to healthy animals introduced. Although no adult ticks were found on the cases examined transmission must have been by means of ticks. According to

Galli-Valerio's observations *Ixodes ricinus* is of very common and wide-spread occurrence in the Canton of Vaud where these animals came from, while *I. hexagonus* is found there more rarely.

Cominotti (Luigi) & Di Domizio (Giovanni). **L'emoglobinuria dei bovini delle regioni prealpine è una piroplasmosi. Nota preventiva dei dottori.** [The Haemoglobinuria of Bovines in the Cisalpine Districts (of Italy) is a Piroplasmosis. Preliminary Note.]—*Clinica Vet.* 1918. Aug. 31–Sept. 15. No. 16 & 17. pp. 425–430.

In this article the authors bring forward evidence to show that the acute form of cattle redwater occurring for many years past throughout probably the whole of the cisalpine regions in Northern Italy is due to a piroplasm. The origin of the disease had not hitherto been discovered on account of the fact that the piroplasms are often extremely rare in the blood even in fatal cases, although in nearly all cases they may be found in the spleen. The authors believe that the piroplasm is not of the *bigeminum* type on account of its relatively small dimensions and the predominance of ring-shaped forms; paired forms with their pointed extremities directed towards each other and rod-shaped forms are also not observable.

Ticks of the species *Margaropus annulatus* are said to be of frequent occurrence in the affected districts.

Sergent (Edmond) & Sergent (Etienne). **Sur le paludisme des Oiseaux du au** *Plasmodium relictum* **(vel** *Proteosoma***).** [Bird Malaria due to *Plasmodium relictum.*]—*Ann. Inst. Pasteur*, 1918. Aug. Vol. 32. No. 8. pp. 382–388. With 1 chart & 1 text fig.

This article gives a résumé of the observations carried out by the authors at Algiers during the course of the last 12 years on Proteosoma infections of canaries. Five hundred and sixty birds were infected in all either as the result of the bites of infected Culex or intraperitoneal inoculation of blood from infected birds. The resulting infection was of approximately the same character in both cases. The period of incubation varied from three to ten days. In one case only it lasted over a month and the disease subsequently ran its normal course. A period of acute infection then follows during which parasites can be observed daily in the blood and this lasts on an average nine days without remissions (minimum 3, maximum 29 days). All the birds showed during this period at least one parasite per field of the microscope (1/15th lens) on an average for six consecutive days (minimum 1, maximum 27 days). In some cases 80 per cent. of the red corpuscles were invaded and up to four parasites might be found within a single corpuscle. The mortality amounted to 61·3 per cent. during this acute stage.

On post-mortem examination the spleen was found to have become enormously enlarged and black in colour. In the normal canary the spleen measures 3 to 4 by 2 millimetres on an average, but in the case of birds dead during an acute attack it might reach up to 15 by 5 millimetres. After this acute stage the parasites disappear in a few days (from 3 to 6 days) from the peripheral blood. Subsequently in some cases there is a complete absence of parasites in the peripheral blood while in other cases a few rare parasites appear at irregular intervals.

During this stage, which may last over 15 months, inoculation with a certainly infective virus does not bring about the appearance of parasites in the peripheral blood. Sometimes there occurs a very mild relapse of brief duration with a very short incubation period (1 to 3 days). This is analogous to the so-called "acclimatisation" of human beings long resident in malarial countries. This immunity is acquired from the sixth day after the commencement of the blood invasion. The birds remain infective for canaries inoculated with their blood or for Culex allowed to bite on them during this period. This stage may be of much shorter duration. After four months the canaries may no longer be infective and appear to be completely recovered. If the spleen is examined it shows no pigment and it is found to have resumed its normal dimensions. In other cases these birds may succumb more readily than non-infected canaries as the result of adverse circumstances such as cold or sudden heat. The spleens of such birds are then found to be large and black. The immunity set up is thus relative. The authors have previously shown that this relative immunity can be set up by the inoculation of sporozoites maintained in vitro.

The bird may be infected in the following ways:—(1) by intraperitoneal inoculation. A few drops of infective blood thus inoculated set up infection with certainty and give much more constant results than subcutaneous or intramuscular inoculation. The authors' virus obtained originally from a Mitidja sparrow was preserved at first by passage alternately through canaries and gnats, but for the last four years this method has been replaced by intraperitoneal inoculation. The incubation period lasts on an average from 7 to 8 days, although the first parasites may appear at the end of three days. The longest period observed was 10 days. (2) By smearing Culex on the skin of the canary. The authors have already shown that if infected gnats are crushed and rubbed on the skin of canaries about four out of every 10 birds become infected. (3) By intrarectal injection; after injection of infected blood one canary out of six becomes infected, the five non-infected ones were shown to have acquired no immunity.

Infection of mosquitoes.—The authors have shown that the sexual development of *Plasmodium relictum* may become accomplished in the body of *Stegomyia fasciata*; this fact has been subsequently confirmed by the observations of NAUMANN (R. O.). In addition the authors have now demonstrated that the complete development of the parasite may also take place in *Culex sergenti* Theobald, *Theobaldia spathipalpis* Rondani, *Acartomyia mariae* Sergent and Theobald; the larvae of these flies live only in salt water (from 30 to 60 grammes of salt per litre) in creeks along the Mediterranean coast. The infection transmitted by the bite of Acartomyia is well marked but delayed. The incubation period is 11 days instead of from 3 to 10 days.

As opposed to what occurs in filariasis one finds in the proboscis of a mosquito that has imbibed Plasmodium blood approximately the same number of parasites as in the circulating peripheral blood.

At a temperature of 11·5° to 24° C. the zygotes take more than two months to mature; sporozoites do not become liberated until between the eighth and ninth week.

The authors have shown that in summer (18° to 30° C.) *Culex pipiens* that have infected a canary can without further imbibition of parasites infect a second canary within a period of one month, but fail to infect a third bird. The infected *C. pipiens* may retain their sporozoites for five months at a temperature of 8–25° C. At the end of this time the size of the sprozoites contained in their salivary glands may become less than that of normal young sporozoites (from 8 to 10μ instead of 11 to 14μ). A canary bitten by two gnats of this same lot (those examined had all shown sporozoites) did not present any infection subsequently. However, examination of the salivary glands of a Culex of the same lot showed 9 days afterwards numerous sporozoites of normal appearance.

Culex born from infected gnats were found to be not infective showing that the parasite is not passed through the egg.

The gnats were found to have acquired no immunity, as Culex that had ceased to become infective became infected again after sucking Plasmodium containing blood.

The authors then describe two trypanosomes, one from the blood of a canary and the other from the blood of the Algerian sparrow.

CREMONA (Pietro). **Sulla diarrea rossa (coccidiosi intestinale) dei bovini del Veneto.** [Bovine Red Dysentery (Intestinal Coccidiosis) in Venetia.] *Nuovo Ercolani.* 1918. May 31. Vol. 23. No. 10. pp. 113–115.

In this short note the author describes a few cases of coccidiosis in cattle, tending to give support to the view put forward by SANLORENZO that the disease is by no means rare in Italy [see this *Bulletin*, Vol. 6, No. 1, p. 9]. In one outbreak involving both calves and adult cattle the disease was reported to have assumed a somewhat virulent character; the animals became affected with foetid diarrhoea, rapid wasting, and finally convulsive tremors just before death, which took place in three or four days. Good results were obtained by the administration of thymol *per os* in 10 gramme doses for calves and 15 gramme doses for adults. Five gramme doses were given as a preventive to the apparently healthy in-contact cattle.

BALLS (A. K.) & MORAL (José D.). **Studies on the Action of Certain Antiseptics, Toxic Salts, and Alkaloids against the Bacteria and Protozoa of the Intestine of the Rabbit.** *Proc. Soc. Exper. Biol. & Med.* 1918. May 15. Vol. 15. No. 8. p. 125. *Jl. Infect. Dis.* 1918. Oct. Vol. 23. No. 4. pp. 382–391. With 4 tables.

The following summary of the above work is given in the first paper.

"The authors believe from theoretical considerations that there is a difference in the susceptibility of bacteria and protozoa to the action of antiseptics. This difference is found to exist between the intestinal bacteria and the intestinal protozoa (*Giardia cuniculi*) of the rabbit, when treated with certain dilutions of chloramine T, brilliant green, 'Halazone' and copper sulphate.

"In these cases the protozoa are more resistant than the bacteria. Therefore bacterial-free material containing live protozoa is easily obtained.

"This behavior does not hold for free living protozoa which are more sensitive to the action of these same antiseptics than the bacteria which accompany them in nature. Free living protozoa are also less resistant when compared with parasitic protozoa.

"Increase in temperature greatly increases the effect of the antiseptics, especially against the protozoa.

"The authors conclude:

"(1) In the intestinal content of the rabbit, it is possible to show that resistance of *Giardia cuniculi* against the action of certain antiseptic substances is markedly greater than the resistance of the intestinal bacteria. It is possible by making use of this difference in resistance to obtain *Giardia* free from all living bacteria, but attempts to subsequently grow them in pure culture have not succeeded. (2) The *Giardia* are more resistant to the action of these toxic substances than are the free living protozoa studied. (3) A technical method has been developed which we believe will be useful in demonstrating the applicability of intestinal antiseptics against both the protozoa and the bacteria of the intestine."

DISEASES DUE TO METAZOAN PARASITES.

Liston (W. Glen) & Soparkar (M. B.). **Bilharziosis among Animals in India. The Life-Cycle of** ***Schistosomum spindalis*****.** Preliminary Note.—*Indian Jl. Med. Res.* 1918. April. Vol. 5. No. 4. pp. 567–569.

Schistosomum spindalis was first found by Montgomery (1906) in two Plains cattle at Muktesar in India and he proposed this name for the new species on account of the characteristic spindle-shaped ova. Outside India it has been found but once, in Sumatra, by Vryberg (1906). In the course of an investigation undertaken by the authors into the possibility of the spread of human bilharziasis in India through the arrival of infected troops one of the several species of fresh water molluscs (*Planorbis exustus*) met with in Bombay was found to be infected with a certain furcocercous cercaria very closely resembling the cercarial stage of the schistostomes found in man in Egypt. Experiments were made in order to ascertain whether these were the cercariae of human schistostomes.

In the first instance an attempt was made to infect a monkey and some guinea-pigs with the cercariae, for it has been shown that in the case of the cercariae of human schistostomes both these animals become heavily infected and mature male and female worms can be recovered from them in about 10–12 weeks. A monkey was drenched with water containing a very large number of the organisms; during the succeeding three months it showed no signs of disease and on post-mortem examination no worms could be discovered. Two guinea-pigs were subjected to infection by allowing water containing cercariae to dry on the shaved surface of the abdomen and groins; they were also made to drink some of this water. One of the guinea-pigs died seven weeks after infection and on post-mortem examination several Bilharzia worms were found in the liver, spleen, and portal veins. The worms, however, were all males and no females could be detected. The other guinea-pig was killed two weeks later and again only male worms were found.

These results showed that the cercariae were a stage in the development of some schistostome and it was probable that they were not the human species found in Egypt for they had failed to develop in the monkey, which had been shown to be a suitable host for the Egyptian worms.

As bilharziasis is known to exist in goats, sheep, and cattle the authors next endeavoured to find whether the cercariae would develop in the body of a goat. A young kid was therefore subjected to infection through the skin by allowing water swarming with the cercariae to remain in contact with the shaved surface of the abdomen and groins for 15 to 20 minutes. Two months and a half later the kid began to suffer from diarrhoea and an examination of its faeces revealed the presence of peculiar spindle-shaped eggs containing active miracidia, corresponding exactly to the description given by MONTGOMERY of the eggs of *Schistosomum spindalis.* The kid gradually grew worse, suffering from severe anaemia, diarrhoea, debility, and paraplegia, with oedematous swellings under the jaw and along the neck, and it died a fortnight later. On post-mortem examination numerous worms in all stages of development were found in the liver. The larger portal veins were packed with worms. The mesenteric veins contained several paired forms. Most of the female worms contained characteristic spindle-shaped ova in the uterus and numerous eggs were found in the minute blood vessels and in the walls of the intestine. The worms were identified as *Schistosomum spindalis* Montgomery.

An attempt was then made to infect snails with the miracidia hatched out of the spindle-shaped eggs obtained from the goat, in order to ascertain whether the same kind of sporocysts and cercariae would develop in them as were found in naturally infected snails. The experiment proved successful and after five weeks most of the snails that were alive had developed sporocysts and cercariae morphologically identical with those with which the kid had been infected. Details concerning the various stages in the development of the worm in the intermediate and final hosts are promised in a further communication.

HALL (Maurice C.), WILSON (Robert H,), WIGDOR (Meyer.) i. **The Anthelmintic Treatment of Equine Intestinal Strongylidosis.**—*Jl. American Vet. Med. Assoc.* 1918. Oct. Vol. 54. New Ser. Vol. 7. No. 1. pp. 47–55.

—, —, —. ii. **Some Notes on the Treatment of Equine Ascariasis and Oxyuriasis.**—*Ibid.* pp. 56–57.

iii. WIGDOR (Meyer). **A Study of the Character of the Feces due to Various Foods in Connection with Anthelmintic Investigation.**—*American Jl. Vet. Med.* 1918. Sept. Vol. 13. No. 9. pp. 441–444.

The very common and rather serious parasitic infestations of the large intestine of the horse, due for the most part to species of the genera Strongylus (Sclerostomum) and Cylicostomum (Trichonema, Cylicostomum, "*Sclerostomum tetracanthum*"), have hitherto been regarded as very difficult of treatment. For example, RAILLIET (1915) states that it is difficult to expel parasites from the large intestine by oral medication in any host species, and this is the general view of parasitologists and veterinarians. However, to the authors' surprise their experiments showed that the above strongyles could be removed with great certainty and with a high degree of efficacy as regards the number removed compared with the number present. Inasmuch as their findings were completed by post-mortem examination their results are of much value.

The high degree of efficacy obtained in the removal of worms from the caecum and colon of the horse was attributable to the increase in the time factor as regards period of exposure of the worm to the anthelmintic. Anthelmintic efficacy is said to be the product of certain factors,—the potency of the drug, the amount of the drug, the contact with the worms, and the period of contact with the worms. In a general way, an increase in any of these factors increases their product, which is the anthelmintic efficacy. Food and drugs pass rather rapidly from the stomach and through the small intestine of the horse, but they lie for comparatively long periods in the caecum and double colon, and thus the high efficacy of the anthelmintics is probably due to the long period during which they may operate in the large intestine. In the case of the horse's caecum food enters through one aperture and passes out through another, a condition which is not present in the other domesticated animals; in the experiments of Hall and FOSTER (1918) it was found quite possible for drugs to pass the ileo-colic or ileo-caecal valve into the colon in dogs without entering the caecum. This is not possible in the horse, so that drugs can be depended on to enter the caecum if they pass the ileo-caecal valve.

The method used in the experiments was the one already published by Hall (1907) in connection with the study of the action of carbon bisulphide on bots. One author administered the drugs, supervised the feeding and fasting of the horses and the collection of the manure, and made the general post-mortem examination. The others made daily collections and identifications of the worms from the manure, collected and identified the worms present post-mortem, and noted the condition of the digestive tract post-mortem. Worms were only identified as far as their genus was concerned; the results did not indicate that any particular species showed any special resistance.

The authors quote references dealing with the treatment of strongylidosis by means of drugs,—thymol (GILES, THEOBALD), atoxyl (DORN and BOCHBERG), carbon bisulphide (LENEVEU, 1915), thymol, santonin, and aloes in the form of a ball (CONREUR 1915), and oil of chenopodium (THUM 1915, WOOLDRIDGE 1916).

The following are the authors' conclusions to their ten experiments:—

"Iron sulphate in the light dose used (2 drams in a mash daily for 7 days) was a failure, removing no *Strongylus* and less than 1 per cent. of the *Cylicostomum* present. Not too much may be concluded in regard to the value of larger doses, but in view of the fact that this treatment is not recommended for strongyles, it is likely that it is not of much value. This conclusion is substantiated by the poor results obtained from the administration of 7 ounces of iron sulphate over a period of 12 days in the case of Horse No. 1031.

"Tartar emetic in the light dose used (2 drams in a mash daily for 5 days) was a failure, removing less than 1 per cent. of the strongyles present. The evidence of severe irritation in the digestive tract post-mortem inclines us to believe that this drug is not apt to prove of much value in this condition, as increased size of dose to secure greater efficacy would mean a degree of gastro-intestinal irritation that in our opinion should be avoided

"Turpentine in a moderate dose (2 ounces in a quart of linseed oil) was a rather effective remedy in the one test made, removing all of the *Cylicostomum* and 48 per cent. of the *Strongylus*.

"Oil of chenopodium was a failure in small doses with less than a 24 hour fast, failing to remove 1 per cent. of the strongyles present in a dose of 8 mils; it was less than 1 per cent. effective against *Strongylus* and only 29 per cent. effective against *Cylicostomum* in a dose of 10 mils. In larger doses, with less than a 24 hour fast before treatment, the findings are somewhat contradictory; a 16-mil dose was 100 per cent. effective against *Cylicostomum* and 76 per cent. effective against *Strongylus*, while an 18-mil dose was 11 per cent. effective against *Cylicostomum* and less than 1 per cent. effective against *Strongylus*. In these same larger doses, with fasts of at least 24 hours, the treatment is highly effective. In one case, where the chenopodium and linseed oil were given simultaneously, the treatment was apparently 100 per cent. effective against strongyles; in another case, where the linseed oil was given 2 hours after the chenopodium, the treatment was 100 per cent. effective against *Cylicostomum* and 96 per cent. effective against strongyles; in another case, where the chenopodium was given in divided doses followed by linseed oil an hour after the last dose, the treatment was 100 per cent. effective against *Cylicostomum* and 95 per cent. effective against *Strongylus*.

"Summary. Contrary to what has been supposed, the removal of strongyles from the large intestine of the horse presents no great difficulties. The remedy of choice is oil of chenopodium, which displays an efficacy of 95 to 100 per cent. when given to horses fasted 36 hours and given in doses of 16 to 18 mils, in one dose or in divided doses, accompanied by a quart or a litre of linseed oil or followed one or two hours later by this amount of linseed oil. The small worms, *Cylicostomum*, are more readily removed than the large, red palisade worms, *Strongylus*, probably due to the fact that *Strongylus* attaches to the mucosa and *Cylicostomum* does not. Turpentine appears to be the second choice of the remedies tested. In the doses used, iron sulphate and tartar emetic gave very poor results and promised little of value in the treatment of strongylidosis."

[It is not clear from this paper whether the drugs mentioned would have any effect upon the innumerable embryos found imbedded in the mucous membrane of the caecum and colon in severe cases of equine strongylidosis, and which no doubt contribute very largely to a fatal termination, or whether the results apply only to those worms lying in the bowel contents of milder cases.—Ed.]

ii. These investigations were carried out concurrently with the above. Of the ten horses used in the above experiments seven were infested with *Oxyuris equi*, and eight with *Ascaris equorum*. The various treatments enumerated above failed entirely to remove the oxyurids and were also entire failures in the case of four of the eight horses affected with ascarids. These results are not considered to be especially encouraging but they constitute a valuable guide for further work on the subject.

iii. The effect of the nature of the food on the character of the faeces was studied in over 100 dogs out of a series of 325 dogs used in anthelmintic investigations, and the following is briefly a summary of the observations:—

"Soft light-coloured plentiful feces are indicative of a bread diet. Dark fairly hard feces in comparatively small amounts are indicative of a raw-meat diet. Very dark fairly soft feces in small amounts are indicative of a finely chopped cooked-meat diet. (This seems to be especially true when the meat is fed while still warm). Clay-colored, brittle feces in small lumps are indicative of some bone constituent in the diet.

"Therapeutic doses of oil of chenopodium or distillation products of oil of chenopodium, when given with castor oil, usually cause greenish, fluid feces, regardless of the diet.

"Excessive or lethal doses of chenopodium constituents cause constipation, in spite of therapeutic doses of castor oil, defecation being suppressed for a period of one or more days or the feces being hard and dark."

HADWEN (S.). **Natural Occurrence of Eosinophilias.**—*Jl. Parasit.* 1918. Mar. Vol. 9. No. 3. pp. 135–137.

Smears made from the swelling observed in from 20 minutes to half an hour after subcutaneous injection of juices obtained from Hypoderma larvae contaminated with bacteria show phagocytosis by the eosinophiles. The reason for the eosinophiles assuming the role which is usually assigned to the neutrophiles is apparently to be found in the fact that the bacteria are rendered attractive by their being bathed in verminous juices. These findings, which are in agreement with those of WEINBERG and SEGUIN (1914–1915), indicate that the eosinophiles play a very important role in picking up the bacteria which are introduced into the body by the bites of intestinal parasites and in neutralising toxins which may be absorbed. The same effect may be produced by puncturing or crushing a warble larva *in situ* under the skin.

It can be proved that the eosinophiles are attracted by the secretions and excretions of the warble larvae alone and not by bacteria if one examines the fluids in the swellings produced by sterile larvae or by the injections of sterile extracts. On the other hand neutrophile leucocytes are found to be the immensely predominating type in smears made from purulent subcutaneous cavities containing warble larvae and invaded by bacteria. Moreover, if one instils a few drops of warble juice into a steer's eye the cells contained in the mucopurulent discharge subsequently produced (9 hours later) are found to be practically all eosinophiles. This experiment also shows that the eosinophile cell is par excellence the agent which truly repels and neutralises verminous products.

Experiments are contemplated to determine what curative effects the injection of worm juices may have on a verminous infestation.

VAN ES (L.) & SCHALK (A. F.). **Sur la nature anaphylactique de l'intoxication parasitaire.** [Anaphylactic Nature of Parasitic Intoxication.]—*Ann. Inst. Pasteur*, 1918. July. Vol. 32. No. 7. pp. 310–362. With 1 text fig. & 4 charts.

The experiments described by the authors in this paper were performed at the Agricultural Station, North Dakota, U.S.A., in connection with their investigations on the nature of "swamp fever" in horses. In 1914 K. R. & R. SEYDERHELM of Strassburg, in a series of three publications on this affection, argued that it could be set up artificially by the injection of watery extracts of *Gastrophilus equi* and *hemorrhoidalis*, and that in natural conditions it was not set up by the filterable virus of VALLÉE & CARRÉ. [The latter authors, however, (see this *Bulletin*, Vol. 4, No. 3, p. 124) subsequently showed that the SEYDERHELMS' interpretation of the action of their larval extracts was obviously fallacious.—ED.] Van Es and Schalk likewise state at the beginning of their paper that the conclusions of the SEYDERHELMS were of an astonishing nature and creative of great doubt. The idea that insects played a part as vectors contained nothing new or unexpected but the rejection of a living virus as the cause of an apparently infectious disease was surprising. Nevertheless the results reported to have been obtained could not be accepted without careful verification and consequently the experiments described in this paper were performed in order to throw more light on the new theory advanced. In the first place the investigations were directed towards studying the effects produced by injections of extracts of Gastrophilus larvae into the horse.

In summarising the results obtained in the course of a very considerable number of carefully performed experiments with extracts of bots and various parasitic worms the authors feel justified in drawing up the following conclusions:—

"(1) There is no reason to believe that species of Gastrophilus play a specific role in the etiology of infectious anaemia or 'swamp fever' of horses.

"(2) The severe intoxications following upon injections of bot extracts are not caused by a specific substance in the manner of the so-called 'oestrine' of the Seyderhelms.

"(3) Such intoxications are only manifestations of anaphylaxia and are strictly analogous to those provoked by any other kind of protein material.

"(4) Several species of parasites sensitise their hosts which, after an initial (*dechâinante*) injection or instillation, respond by anaphylactic or allergic reactions.

"(5) The toxic properties capable of becoming evident to a striking degree in the case of extracts of certain parasites are due to a specific sensitisation of the animals at some anterior date.

"(6) It is reasonable to suppose that the substances which provoke the anaphylactic shock may be introduced into the circulation by the same channels as those along which the sensitising materials travelled beforehand.

"(7) Owing to the more or less constant presence of certain parasites in some part of the body it is quite possible that the latter is constantly charged with anaphylatoxins of parasitic origin.

"(8) It is also possible that such an intoxication may lead to morbid changes of a more or less well-defined and characteristic nature.

"If one accepts this idea with regard to a parasitic anaphylaxia several problems become presented to the investigator. For example, what are the consequences of such a prolonged anaphylactic intoxication? Does it bear any relationship with any chronic diseases such as various types of anaemia, sclerosis, parenchymatous degenerations and morbid conditions hitherto lightly attributed to auto-intoxication, and further what modifications are brought about in the composition of the blood of some of the anaphylactic horses used in the experiments and found to be capable of producing febrile reactions in subjects inoculated with it? . . . Hadwen's discovery" [see this *Bulletin*, Vol. 5, No. 2, p. 109] "also presents a number of points of great practical interest. It might be employed as a method of diagnosis in certain parasitic diseases. It would be possible in the case of a flock affected with gid to determine which sheep harboured cysts by obtaining an ocular reaction after the instillation of an extract of *Taenia coenurus* or the contents of its cyst. The allergic or anaphylactic reactions might also serve in the course of researches on the biological relationships existing between the parasites and their hosts. . . ."

DE MEZA (John). **The Common Ticks of Nyasaland with some Special Notes on the Anatomy and Biology of Ticks in General.**—*Nyasaland Protectorate. Department of Agriculture.* Bull. No. 1. of 1918. 32 pp. With 13 text figs. Zomba: Govt. Printer.

This short monograph aims at giving "a short general description of the Order, describing the points which distinguish the different sub-families and genera; to describe the biology and anatomy of ticks in general, and to describe in some detail the disease-causing ticks of Nyasaland giving at the same time their life history." Although the author's information has been abstracted for the most part from the publications of NUTTALL (G. H. F.) it nevertheless presents a useful elementary summary on the subject of ticks together with a number of clear sketches. The common ticks of Nyasaland concerning which more or less detailed information is given are the following:—*Argas persicus*, *Ornithodorus moubata*, *Boophilus decoloratus*, *Haemaphysalis leachi*, *Dermacentor rhinocerotis*, *Rhipicephalus appendiculatus*, *R. evertsi*, *R. falcatus*, *R. simus*, *R. capensis*, *Hyalomma aegyptium*, *Amblyomma variegatum*, *Amblyomma hebraeum* and *Aponomma exornatum*.

BISHOPP (F. C.), MITCHELL (J. D.) & PARMAN (D. C.). **Screw-Worms and other Maggots affecting Animals.**—*U. S. Dept. Agric.*, *Farmers' Bull.* 857. 1917. Sept. 20 pp. With 8 text figs. Washington: Govt. Ptg. Office.

The so-called "screw-worm" inflicts enormous losses on the stock-raisers of Texas, Oklahoma, New Mexico, Arizona and South California during the warmer periods of the year. In some districts the rearing of young calves is nearly entirely prevented on account of its ravages, adult stock are in many cases killed outright or maimed permanently, while infested sheep always lose flesh and their milk production decreases. The expense of watching herds and treating infested animals also is considerable. The maggots of several other kinds of flies in addition infest wounds and "blow" soiled wool on sheep. All these flies breed in decaying animal matter, especially in carcases of large animals. Carcases should thus be disposed of by burning or by burying under at least two feet of soil after covering with quicklime.

An extract has already appeared in this *Bulletin* [(DUNN, L. H.), Vol. 6, No. 3, pp. 161–163] dealing with the nature of the injuries due to this screw-worm pest together with an account of its life history and methods for its control.

For destroying the screw-worm maggots in a wound nothing better than chloroform has been found. The dead or comatose maggots should be removed with a pair of forceps, the wound cleaned out with 5 per cent. carbolic acid solution and pine tar applied to act as a repellent for flies. Tannic acid dusted over the wound will check bleeding and make it less attractive to flies. The former extensive use of calomel in wounds is now practically discontinued.

REAKES (C. J.). **Notes regarding Ticks found on Farm Animals in New Zealand.**—*Jl. Agric. Wellington, N.Z.*, 1918. Feb. 20. Vol. 16. No. 2. pp. 83–86.

The ticks which transmit bovine piroplasmosis in Queensland and North America [*Margaropus* (*Boophilus*) *annulatus australis*, and *M. annulatus*, respectively,] have never been discovered in New Zealand.

The ticks that occur on cattle are *Ixodes ricinus* (commonly called the "dog tick" or the "castor bean tick") and a species of Haemaphysalis. Although piroplasmosis or any other serious trouble caused by ticks does not exist among cattle in New Zealand, yet the experience of other countries goes to show that ticks may be the source of trouble to stockowners in the future inasmuch as they occasion loss of condition, decrease in the milk yield, deterioration in the value of hides, and mortality among animals already weakened by various forms of sickness, insufficient food, or other causes. Measures are thus advised for their eradication. It is recommended that the infested parts of the skin should be sprayed with Stockholm tar after which all dead ticks should be collected and burned. Other spraying preparations tried and found to be somewhat less effective consisted of kerosene ½ pint, linseed oil ½ pint, and sulphur 1 ounce; or kerosene 10 ounces, lard 10 ounces, tar 2 ounces, sulphur 1 ounce. Very strong solutions of sheep dips also proved effective but cattle were liable to suffer from their effects when used at the necessary strength. Dipping is the only effective method available in the case of cattle unaccustomed to handling.

Hill (G. F.). **Some Notes on the Bionomics of the Buffalo-Fly (*Lyperosia exigua*, Meij.).**—*Proc. Linn. Soc. N.S.W. Sydney.* 1917. Apr. 4. Vol. 41. No. 164. pp. 763–768. With 1 plate. Abstracted in *Rev. App. Entom.* 1918. June. Vol. 6. Ser. B. Part 6. pp. 118–119.

"*Lyperosia exigua* (buffalo-fly) is a more formidable pest to cattle and horses in northern Australia than the larger and more voracious blood-sucking flies, owing to the greater number of individuals and the longer period of their seasonal occurrence. During the early part of the wet season (November and December) certain Tabanids, especially *Tabanus nigritarsis*, Tayl., cause greater annoyance and loss of blood than buffalo-flies, but their wounds heal without showing signs of inflammation, while the attacks of *Stomoxys*, *Lyperosia*, *Musca* and other flies cause characteristic sores.

"Old and sickly horses and cattle are most commonly attacked, goats are rarely molested, while dogs, pigs, sheep and kangaroos appear to be immune. The parts attacked are chiefly the belly, brisket, underparts of the neck, flanks and about the eyes. Buffaloes, both domesticated and wild are habitually infested, and man is occasionally bitten while riding fly-infested horses.

"This pest was probably introduced with stock from the East Indies subsequent to 1824, its present distribution in Australia coinciding fairly well with that of the introduced buffaloes.

"The eggs are laid singly to the number of 12 to 20 in dung or foul mud, the larvae, which emerge in 18 to 20 hours, burrowing into the dung, where they pupate after 3 or 4 days. The adults appear after a pupal period of 3 to 5 days, and seek their hosts, resting during the heat of the day and at night upon the flanks and withers of horses and about the horns of cattle.

"Natural enemies of the fly are few, insect predators being chiefly certain species of ants that gather the eggs for food, especially *Solenopsis geminata*, F., var. *rufa*, Sud., *Iridomyrmex detectus*, Smith, and *Odontomachus ruficeps*, Sm., var. *acutidens*, Forel. A more important enemy is a small Hymenopteron, *Sericophorus relucens*, Sm., which captures the flies while feeding or at rest.

"Artificial control over the immense and thinly-populated grazing areas would be obviously impracticable, but the frequent removal of manure from milking-pens and cow-yards would prevent these places acting as sources of infestation."

VAN ZWALUWENBURG (R. H.). **Cattle Ticks.**—*Report of the Porto Rico Agric. Exp. Sta.*, 1916. pp. 25–26. With 1 plate comprising 2 figs. 1918. Washington: Govt. Ptg. Office.

"Two varieties of ticks infest cattle in Porto Rico. The more common is the Australian tick (*Margaropus annulatus australis*). The typical *M. annulatus* of the Southern States is also present, but in much smaller numbers.

"Control of the tick by starvation or dipping is dependent for success upon an exact knowledge of the parasitic and nonparasitic development of the acarid in the locality in which control work is to be done. This work is well under way, and data are being collected on the variation of the stages during the different seasons of the year.

"At Mayaguez the Australian tick required 20 to 22 days for its development on the host during the fall months. Hence, if local eradication of the tick is attempted, applications of dips, sprays, or smears should be renewed about every three weeks to prevent the maturing of fresh generations. The minimum egg period under natural conditions was found to range from 36 days, beginning in February, when the average mean temperature was 74·7° F., to 23·5 days in September, when the average mean temperature was 79·6° F. The maximum starvation period of ticks hatching in April was found under natural conditions to be 94 days. Seed ticks protected from rain and direct sunlight had a maximum starvation period of 108 days."

BACTERIAL DISEASES.

MORRIS (Harry). **Blood-sucking Insects as Transmitters of Anthrax or Charbon.**—*Agricultural Experimental Station of the Louisiana State University and A. & M. College*, Baton Rouge. 1918. March. Bull. No. 163. 15 pp. With 2 text figs. & 3 tables,

In work carried out in the Louisiana Experimental Station for the past three years an attempt has been made to find out the relation between certain blood-sucking insects and the transmission of anthrax. Very few data concerning this subject are to be found in the literature on anthrax. SCHUBERG and KUHN (1912) transmitted anthrax from a carcase to a living animal through the biting of *Stomoxys calcitrans*. MITZMAIN (1914) in the course of an extensive piece of research work succeeded in transmitting the disease through the bites of *Stomoxys calcitrans* and *Tabanus striatus*. In Louisiana DALRYMPLE and DODSON (1900) produced strong circumstantial evidence to incriminate blood-sucking flies as vectors of anthrax by compiling a record to show the relationship between their prevalence and the occurrence of the disease.

Inasmuch as there appeared to be some unknown factor involved in the continuance and spread of several outbreaks in Louisiana Morris undertook a study of the most common blood-sucking insects of the country and by means of experiments on animals under as natural conditions as possible endeavoured to ascertain the rôle of the flies in the transmission of anthrax. The flies used were the horn fly *Haematobia irritans* L., a horse fly *Tabanus* sp. near *nigrovittatus* Macq., and the mosquitoes *Psorophora* (*Janthinosoma*) *sayi* D. & K., and *Aedes sylvestris* Theob.

The horn fly is one of the most predominant of all species of blood-sucking flies in Louisiana. It is prevalent during the greater part of the year and is found during the summer months in swarms feeding on cattle and more especially on those with dark coats to avoid detection. Numbers of these flies, varying from 100 to 300 for each experiment, were caught and confined in a wooden cage with a curved top covered with a fine wire screen. Great difficulty was experienced in keeping the flies alive in captivity owing to the fact that if left unfed for 12 hours they would practically all die, and thus frequent feeding upon a living animal was necessary. A guinea-pig which had been previously inoculated subcutaneously or intraperitoneally with a loopful of anthrax spores was tied on the wire screen of the cage and allowed to remain for one minute. Then after removing the animal the screen was disinfected with perchloride of mercury solution and a healthy guinea-pig fastened on the cage and allowed to remain from one to three minutes. The horn fly will usually feed from four to six minutes and so by this method the feeding was interrupted. From the results of a considerable number of experiments it was found that transmission of the disease to the healthy guinea-pigs commenced to take place when the flies were allowed to bite infected animals four hours before death (11 per cent. of cases) and the percentage of positive results became increasingly higher until within a few minutes before death (54 per cent. at 30, 50 per cent. at 15, 55 per cent. at 5 minutes before death); at death transmission took place in 33 per cent. of cases, 15 minutes after death in 10 per cent., while 30 minutes after death the results were all negative. In some cases the internal form of anthrax was produced but in the majority the external or carbuncular form was most common. The guinea-pig died at any time from 48 to 82 hours after having been bitten by the flies.

A few experiments were conducted in which an appreciable period of time elapsed between the feeding on the infected host and the susceptible animal; the results were negative in all cases.

In a series of experiments in which an infected sheep was used as the source of infection one guinea-pig out of two became infected when the flies had fed on the sheep 30 minutes before death, and in all cases where the flies had fed 15 minutes before death, at death, and 15 minutes after death (nine guinea-pigs used altogether in these experiments).

In the experiments with the horse fly, Tabanus sp., small glass jars covered with wire gauze were used, one fly being placed in each jar. This fly appears in great numbers during the latter part of August and in September, and bites with great avidity in captivity. The fly was allowed to bite the abdominal surface of an infected guinea-pig, and then as soon as it had commenced to feed the jar was transferred in a similar manner so as to come into contact with the abdominal surface of a healthy guinea-pig. If after contact with the infected animal the metal cap became soiled with blood it was replaced by a clean one before the fly was allowed to feed on the uninfected animal. In these experiments positive results were obtained in all cases where the flies were allowed to bite the infected animals at intervals from four hours before death (16 per cent.) up to the time of death (100 per cent.); when allowed to bite

16 minutes after death the positive results amounted to 16 per cent., and 20 minutes after death 0·0 per cent. The flies would not feed satisfactorily on the dead body of a guinea-pig.

Under field conditions another species, a black horse fly, *Tabanus atratus* Fab., sometimes feeds on dead bodies 30 minutes or more after death. Virulent cultures of anthrax were obtained from the bites of these flies that had fed upon the carcase of an animal dead of anthrax. The flies could not be induced to feed in captivity although a great number were collected and a different technique used. It is quite common during the fly season to see blood dropping from the bellies of horses and mules due to the biting of various species of Tabanus and in this manner anthrax could be spread from animals suffering from the disease.

In the case of mosquitoes a similar technique to that adopted in the case of the horse flies was used and positive results (16 per cent.) were obtained when the flies were allowed to feed three hours before death. The number of positive results increased up to 70 per cent. when biting took place at the moment of death, 10 minutes later 12 per cent. transmissions were obtained and 30 minutes after death nil.

A number of observations were made with regard to the presence of anthrax bacilli in the excrement of the above named insects. Small bottles were used as retainers for the insects as in the case of the horse fly experiments described above. Some difficulty was experienced in inducing single horn flies to feed and so a dozen had to be confined in a bottle until they had fed and then they were placed in separate bottles. After the flies had fed until engorged with blood, which was shown to harbour large numbers of anthrax bacilli, the bottles were allowed to stand and cultures made each day from the "specks" deposited on the surface of the glass. 1,218 specks from the horn fly were cultivated and 11 produced colonies of anthrax; the positive results were obtained within six hours after feeding upon the infected host. Two colonies of anthrax were found in 318 specks from the horse fly, positive results being obtained within 12 hours after feeding, and one colony of anthrax was found in 711 specks examined from the mosquito (the one positive result being obtained between the 48th and 72nd hour after feeding).

These results would indicate that anthrax bacilli are mostly if not entirely destroyed in the digestive tracts of the above described insects when ingested in the blood of an animal affected with anthrax. It is suggested that the few colonies found might have been produced from the contaminated feet and bodies of the insects. No attempts were made to feed anthrax spores to see if they would pass through the digestive tract.

JENSEN (H.). **Hemorrhagic Septicemia, its Clinical Diagnosis.**—*Jl. American Vet. Med. Assoc.* 1918. Oct. Vol. 54. New Series. Vol. 7. No. 1. pp. 39–47.

In this paper the author gives a concise account of the various clinical manifestations in haemorrhagic septicaemia observed in the course of his experience in Texas. It is there stated to be attended with high mortality and attack various species of animals especially cattle, sheep, and swine. Young animals are more susceptible than adults and animals in poor condition are most liable to be affected. The clinical diagnosis in many cases is exceedingly difficult and can only be arrived at conclusively by laboratory examination, which may necessitate the adoption of experimental animal inoculation. Swine plague caused by a Pasteurella organism alone is very rarely encountered in the field and nearly always represents a mixed infection. Fowl cholera representing the avian form of the disease sometimes causes great losses.

From the point of view of symptomatology and morbid anatomy haemorrhagic septicaemia may be manifested under one or other of the following forms:—(1) pectoral or pulmonary, (2) subcutaneous, (3) cutaneous, and (4) enteric form.

In the pectoral form the period of incubation varies from six hours to eight days, and the symptoms are those of a rapidly developing acute pleuro-pneumonia. On section the lungs are hepatised and show serous infiltration of the connective tissue and the affected portions often present a marbled appearance as seen in contagious pleuro-pneumonia.

In the subcutaneous form swellings appear beneath the skin of the head, throat or dewlap, which are somewhat soft and pit on pressure. The tongue is often swollen and there is marked salivation. Swellings of the legs or various joints may also be observed. On post-mortem examination haemorrhagic areas are found in the subcutaneous tissue, varying greatly in number and in size; in some cases they are so extensive as to involve up to one eighth of the body surface. These areas are infiltrated with a sero-fibrinous exudate usually yellow in colour but sometimes dark red. Minute haemorrhages are found in the muscle tissue. The lymphatic glands are frequently though not uniformly enlarged, the cervical and prescapular glands being most seriously affected.

The cutaneous form, originally called "mad itch," is of rare occurrence and usually manifests itself by the animal showing intense itching and nervousness. Large areas of skin may thus be entirely devoid of hair and rubbed to a raw sore. The animal usually dies in from 12 to 72 hours. This form is often difficult to differentiate from rabies and other cerebral conditions, but on blood examination typical bi-polar staining organisms are discoverable. On post-mortem examination no distinct lesions are often found but there are usually petechiae in the subcutaneous tissues and in the muscle and fat at the base of the heart; none are to be found over the ventricles towards the apex, however, as is often found in other forms of the disease. Haemorrhages occur in the meninges of the brain and spinal cord, and the cerebro-spinal fluid is more or less red in colour.

At times the changes are found chiefly in the abdominal cavity and this form of the disease may occur after it has developed in the lungs. It is usually accompanied by symptoms of colic and severe straining. The animal finally becomes affected with a thin foetid diarrhoea frequently mixed with flakes of fibrin and mucus and blood clot. Sometimes the faeces may be apparently normal except for the presence of blood streaks, but on the other hand the mucous membrane of the intestine may be so badly inflamed that large portions of it are expelled with the faeces, and the excreta in this condition may have the appearance of pure blood. In certain districts this form is very rarely encountered. On post-mortem examination pronounced inflammatory changes are noted in connection with the digestive tract.

In sheep, young animals that have just been weaned are most susceptible, the disease manifesting itself in an acute form; there is high temperature, muscular tremblings, discharge from the eyes and nose and colicky pains. The duration of the disease is usually very short although it may become a chronic infection of the lungs with gradual emaciation of the animal. The disease in many instances is of such an acute nature that no distinct changes are seen post-mortem except for petechiae in the heart, lungs, and spleen and congestion of the lymphatic glands.

In swine the disease sometimes manifests itself in an hyperacute form with the symptoms of a general septicaemia. Red spots may be noted on various parts of the body. The disease may also occur as a necrotic pleuro-pneumonia and the symptoms and lesions in many cases are identical with those of hog cholera.

In cattle the disease has to be differentiated clinically from anthrax, blackquarter, malignant oedema, and rabies.

DISEASES DUE TO FILTERABLE VIRUSES.

SCHERN (Kurt) & VON BARTAL (Robert). **Ueber Rinderpest (Zweite Mitteilung). Ueber Rinderpest-Blutbefunde nach Braddon.** [The Structures described by Braddon in Rinderpest Blood.]—*Ztschr. f. Infektionskr . . . d. Haustiere.* 1918. Sept. Vol. 19. No. 4. pp. 293–305. With 1 text fig.

In 1913 BRADDON (W. L.) described the appearance of "some peculiar and probably specific bodies in the erythrocytes in rinderpest and another allied disease" in the course of his observations in connection with the production of a protective serum for buffaloes in the Malay States [see this *Bulletin*, Vol. 2, No. 1, pp. 45–47]. When rinderpest infected blood was diluted from three to five times its volume of a watery solution of one per cent. potassium citrate and 0·5 per cent. methylene blue there appeared, on examination after a period varying from 6 to 48 hours, upon the blood corpuscle a blue point from which one or more delicate radiating fine lines later developed. These radiate bodies were sometimes found to be completely extruded from the corpuscles. They were said also to exhibit twisting or rotatory movements and these movements were imparted to the corpuscles within which they were included. The bodies were stated to be invariably discoverable in all cases of acute rinderpest during the febrile stages and in the great majority of cases up to eight months after recovery. A somewhat different kind of intra-corpuscular body was described in the case of buffaloes suffering from a disease resembling a mild form of rinderpest. A method was described by means of which the bodies could be stained after fixation.

A number of observations made by JOHNSON (J. C.) on blood corpuscles from various other mammals in a normal state of health or suffering from other protozoan blood infections appeared to lend confirmation to BRADDON'S observations [*loc. cit.*, pp. 47–48]. It is interesting to note that MARTOGLIO, in the course of observations on cattle affected with rinderpest in Eritrea, failed completely to demonstrate the specificity of the above bodies—a reference overlooked by the above authors [this *Bulletin*, Vol. 5, No. 3, p. 195]. Du Toit (1916) in a critical review of the recent literature dealing with rinderpest notes that Braddon's method of mixing blood with an anisotonic solution over a more or less prolonged period constitutes a by no means delicate test, although he himself by following the technique recommended by Braddon with a number of healthy German cattle failed to demonstrate bodies such as were described by that author.

In the course of their work in connection with the production of anti-rinderpest serum at the Pendik Institute in Asia Minor Schern and von Bartal tested the accuracy of Braddon's observations with the blood of animals used for virus production. A number of experiments were made in which the technique recommended by Braddon was closely followed and also the effect of employing solutions of methylene blue alone and of potassium citrate alone and in various dilutions (½ to 2 per cent.) was tested on the bloods of rinderpest-affected and normal cattle, and also of the sheep and horse.

As was to be expected it was found that on allowing the mixtures recommended by Braddon to stand in a test tube the corpuscles tended to settle to the bottom of the tube and thus only the upper layers of the corpuscles came into intimate contact with the staining solution. It was frequently seen that varying appearances were presented by the corpuscles when they did not form a uniform suspension in the fluid. After allowing the mixtures to stand one therefore on examination at various intervals noticed corpuscles that were unchanged in appearance and corpuscles presenting varying degrees of abnormality; the corpuscles taken from the upper layers showed the so-called Braddon's bodies while those from the deeper layers remained free. The various stages in the development of these bodies could thus be followed.

The anisotonic condition of the staining solution also produced various changes in the corpuscles such as the appearance of wrinkles, projections, etc. It was noteworthy that the so-called Braddon bodies were only observed in deformed corpuscles. In no case was a linear body observed to develop out of a punctiform body. It was also striking that the appearance of the so-called Braddon bodies could be brought about by the employment of a solution of potassium citrate alone, whilst they could not be set up by the employment of methylene blue alone. The bodies were demonstrable in the blood of normal animals as well as in that of rinderpest-affected cattle. As the result of their experiments the authors conclude that Braddon's so-called specific rinderpest bodies are simply the products of reaction between the red corpuscles and certain chemical substances especially potassium citrate, and judging from observations on Anatolian cattle they are not specific for rinderpest.

Lagaillarde. **Note sur le sérum virus dans la peste bovine. Immunisation dans le Niani-Ouli.** [Sero-Vaccination against Rinderpest in the Niani-Ouli Region, French West Africa].—*Gouvernment Général de l'Afrique occidentale française.* 1918. Feb. 18. pp. 12. Gorée: Imprimerie du Gouvernemen général.

In this note the author gives an account of the methods adopted by him together with the apparatus necessary for the production of an effective anti-rinderpest serum in the field. The doses administered were 20 c.c. of blood or 10 c.c. of serum. Prior to the use of serum as a prophylactic the mortality in the district had risen to 80 per cent. but after the adoption of sero-vaccination it is said that there was a very striking decrease in the mortality.

Out of 1,375 animals belonging to infected herds, inoculated by means of either fresh, carbolised, or glycerinated bile the losses were 38 per cent.; out of 2,195 animals inoculated in a clean area the losses were 8·04 per cent. In the infected areas only the cattle showing no clinical symptoms were inoculated. The high losses are probably attributable to a large extent to the fact that many of these animals were inoculated during the incubation period of the natural disease.

Di Domizio (Giovanni). **Interno alla profilassi della peste bovina in particolare e alla lotta conro i morbi infettivi del bestiame in generale in Colonia Eritrea.** [Prophylaxis of Rinderpest in Particular and Control of Infectious Diseases of Animals of Eritrea.]—*Moderno Zooiatro.* 1918. Jan. 31 to May 31. Vol. 7. Nos. 1–5. pp. 20–24, 35–48, 60–72, 84–96 & 107–120.

The author's observations on rinderpest carried on in Eritrea in 1912 and 1913 lent confirmation to the view expressed by Zonchello [see this *Bulletin*, Vol. 5, No. 2, pp. 127–128] that the ultimate effect of Kolle and Turner's so-called "simultaneous" method was to bring about invariably the further spread of the disease without exercising any prophylactic action.

This result was not the outcome of a defect in the method as suggested by Zonchello but was attributable to the fact that it was never possible to carry out the details set forth in the official programme laid down in 1905 relating to immunisation of all cattle within a short period of time by means of the method. By that means it should have been possible to obviate any risk of spreading the disease as a result of the sero-vaccination itself. The process instead was always carried out in a partial manner with the result that at least half the bovine population remained susceptible to the disease on each occasion; adequate safeguards were not set up to prevent these animals running any risk of infection originating from the centres under treatment.

In the control of rinderpest in Eritrea the simple ordinary measures of sanitary police (isolation, disinfection, etc.) without active immunisation of cattle will succeed, if they are rigorously applied, in limiting the losses due to an enzootic, but only for a more or less short period of time, that is to say, whilst there are no acute recrudescences of the disease. When, after a few years an area rendered partly or wholly clean by the application of the above police measures becomes completely or almost completely susceptible to infection, then simple sanitary police measures in themselves would not be capable of safeguarding the Colony from an invasion, with disastrous results, of rinderpest from Abyssinia owing to the topography of the Eritreo-Ethiopian border and the diffusibility and severity of the disease.

Of all the actually known means of dealing with rinderpest, active immunisation by Kolle and Turner's method is still the one most strongly indicated in the case of Eritrea, in conjunction with the application of strict sanitary police measures. But, in order to obtain some real advantage from the fact that the method leaves an immunity lasting throughout the whole lifetime of inoculated animals and in order to eliminate its inherent disadvantage, namely, its liability to spread the disease among susceptible uninoculated cattle, the whole bovine population of Eritrea should be subjected to sero-vaccination within the shortest period of time; special precautions should be taken in dealing with the border lands and the inoculations should be repeated every three or four years so as to immunise all cattle born during the intervals and each time the operations should be completed within a period of a few months. In the carrying out of such a programme the production of serum in sufficient quantity would present no real difficulty, for when it had become impossible to produce it within the Colony on account of the deficiency of virus and susceptible cattle following upon the primary general immunisation there would be nothing to prevent its further production in Abyssinia. The essential conditions thus are

(1) that the sero-vaccination should be performed gratuitously; that is, preferably without direct payment, but expenses should be met by an increase in the present tax on cattle;

(2) that a veterinary police service should be organised comprising six veterinarians for each regional commissariat according to the extent of their territory, three or four for Abyssinia, and a like number for administration and serum production.

From an economical point of view such a system of prophylaxis should add at least from 10 to 11 per cent. to the value of the cattle for the native population. These figures must undoubtedly be increased when one takes into account the slight loss in milk, work and meat-producing capacities during the short period following on vaccination compared with that suffered from in the natural disease; the method would, in addition, stimulate the production of cattle among the natives in greater numbers and of better quality.

The danger of transmitting disease of a more or less serious nature by the inoculation of protozoan parasites—which led KOCH and THEILER to condemn the method—can be invariably avoided in Eritrea if the operations are undertaken by competent persons. The author is particularly insistent upon this point inasmuch as he bases his experience on the inoculation of about 80,000 cattle carried out during a period of 18 months under very difficult circumstances and whilst he had not always got at hand a really effective anti-rinderpest serum.

By means of sero-vaccination against rinderpest it would be possible to carry on a very important political programme in the interior of Abyssinia.

The veterinary police organisation would be invaluable in Eritrea not only for prophylaxis of rinderpest whatever method might be adopted (active immunisation and sanitary police, or sanitary police alone) but also for the control of the other contagious diseases existing in the Colony and to prepare the way for improvements in breeding.

When by means of sanitary police and improved breeding a surplus of cattle had been produced in Eritrea exportation of frozen or preserved meat to Italy could take place. But the importation of live animals into Italy should never be countenanced, especially on account of the risk of introducing contagious diseases.

KAKIZAKI (Chiharu). **Study on the Glycerinated Rinderpest Vaccine.** —*Kitasato Arch. Exp. Med.* 1918. May. Vol. 2. No. 1. pp. 59–66. With 5 tables.

Rinderpest has not appeared in Japan since 1909, but the country is now exposed to danger on account of the commercial relations existing between it and China. The author's experiments, involving the inoculation of Korean cattle, which are said to be highly susceptible, were aimed at attenuating or "debilitating" the virus so as to render it fit for vaccination purposes. He states that TAKAZAWA was the first to claim to have diminished the virulence of the virus by passing it through the bodies of pigs. By subjecting the infected tissues and fluids (spleen and defibrinated blood) of cattle that had succumbed to the disease to the action of glycerine the author claims to have successfully attenuated the virus. It could not, however, be preserved for long in this state, and sometimes it showed a tendency to revive. The proportion of glycerine added to the defibrinated blood in these cases is not indicated. No dangerous ill effects were produced upon the inoculated animals. The length of time the above materials were found to harbour the virus in their "debilitated" or attenuated form was found to vary considerably with the temperature. For example, defibrinated blood retained its virulence for 10 days at room temperature while at temperatures below freezing it was found unchanged after 55 days but quite avirulent in 80 days. The avirulent virus contained in the emulsion of glyceinrated infected spleen appeared to retain some antigenic properties, even when the immersion in glycerine has been continued for over a year.

REMLINGER (P.). **Sur la présence du virus rabique dans la rate.** [The Presence of Rabies Virus in the Spleen.]—*Ann. Inst. Pasteur.* 1918. Aug. Vol. 32. No. 8. pp. 406–412.

BABES appears to be the only investigator who succeeded in transmitting rabies by the inoculation of material from the spleen; the spleen of one rabbit out of six experimented on in this way proved virulent. Nevertheless the presence of inflammatory and sometimes even necrotic nodules in the spleen in certain cases of rabies in man and other animals led this author to believe that the organ harboured in some cases the virus, which might thus set up lesions analogous to those found in the nervous centres. With this exception all the observations described in medical literature disclose negative results.

Remlinger carried out a series of experiments with the spleens of guinea-pigs that had succumbed to rabies, in a manner similar to that described in his previous contributions to the study of rabies [see preceding number of this *Bulletin*, p. 181]. From these experiments he considers himself justified in concluding that the rabies virus may be encountered much more frequently in the spleen than has been hitherto recognised. Its presence was revealed eight times in the course of 42 experiments and was proved to be quite independent of post-mortem generalisation inasmuch as 12 guinea-pigs slaughtered just before death would have naturally taken place furnished three positive results. This result must be attributed apparently to the fact that the virus may be found much more frequently in the blood than writers have admitted. MARIE (A.) has already drawn attention to this point, which the author proposes to investigate afresh. Instead of tending to favour the diffusion of the virus in the spleen the onset of putrefaction seems in the first place to render it less frequently discoverable (spleens of animals sacrificed before natural death—3 positive results in 12 experiments; spleens of animals post-mortemed within 12 hours after death 3 positive results in 12 experiments; spleens of animals post-mortemed at longer intervals than 24 hours after death—2 positive results in 18 experiments).

A comparison of these results is, however, somewhat illusory on account of the fact that it is impossible to resort to sub-dural inoculation after the onset of putrefaction and the infection following on intramuscular inoculation is of an appreciably lesser degree of severity.

HECKENROTH (F.). **Contribution à l'étude de la rage en Afrique occidentale Française.** [Rabies in French West Africa.]—*Ann. Inst. Pasteur.* 1918. Aug. Vol. 32. No. 8. pp. 389–398. With 1 map.

The presence of rabies in the dog has been described in French West Africa by CAZALBOU and BOUFFARD in the Sudan, TEPPAZ and BOURRET in Senegal, and ALDIGÉ in Guinea. The disease was said to be intermediate in type between the furious and paralytic forms, with paralytic phenomena predominating. In most cases these authors succeeded in transmitting the disease to the rabbit, dog, and guinea-pig by intra-cerebral or intra-ocular inoculation of emulsion from the rabid brain, causing death in three or four weeks with complete paralysis.

BOUFFARD (1909) showed that the disease was transmissible through rabbits in series, in which animals death was produced after a somewhat variable interval (from 15 to 20 days usually, up to 35 to 38 days) and one rabbit out of every six proved refractory after inoculation. He also stated that canine rabies in the Sudan did not appear to be transmissible to man in natural conditions inasmuch as no case of human rabies had been observed in that country where mad dogs were by no means rare. In addition, rabies is not considered to be transmissible from dog to man in Senegal, Guinea, Dahomey, and the Hausa country. The records of the French Medical Service in West Africa during the thirty years prior to 1915 contain a description of only one well authenticated case of human rabies.

As the result of the death of five natives following on bites from a native dog a month and a half previously the author carried out some interesting investigations at the Dakar laboratory during 1915–1916 on animals suspected of having become infected with rabies. These comprised 12 native and three European dogs and one wild jackal forwarded from various regions. Seven of these animals were slaughtered, seven succumbed to the disease, while two were lost. The slaughtered dogs were for the most part wandering dogs and did not apparently show any sign of paralysis but were furious or dejected and bit men and dogs that came in their way. The course of the disease was followed in the case of six dogs and the jackal. Six of these animals died after having shown dejection, excitability, and modified laryngeal sounds. Human beings or dogs were bitten by four of these animals and paralysis was observed in five instances. In the 16 small investigations undertaken it was established that in three cases the rabid dog had bitten animals or man, in five cases man only, in four cases dogs only, and in four other cases both man and dogs. The exact number of human beings bitten could not be ascertained but six Europeans and 25 natives succumbed to the disease. However, the bites of three of the rabid dogs did not give rise subsequently to rabies though the subjects bitten were kept under observation for more than eight months. Three dogs and a jackal also did not transmit rabies to the persons bitten but anti-rabic treatment was adopted in these cases. Two dogs bitten by two of these animals failed to contract rabies but symptoms were presented by six dogs bitten by three of the other cases. A number of laboratory experiments were made on material obtained from these cases and attempts were made to transmit the virus in series through the rabbits.

The observations made by the author would thus appear to indicate that there exists in Senegal a recently imported rabies virus, responsible for the epidemics among Europeans in 1915, in addition to the already well-known native virus, identical with that of the Sudan inasmuch as it is not transmissible by the bite of a dog to man. Although this hypothesis is supported by the history of certain of the outbreaks it seems on the other hand improbable that a carrier of the foreign virus should not have transmitted its disease to another dog in a country where street dogs are considerable in number and canine rabies is of as frequent occurrence as formerly. Although no rabbits were found to be immune towards infection with the fixed virus of the Pasteur Institute maintained at the Dakar laboratory the virus isolated in 1915 in Senegal and BOUFFARD's Sudan virus did not always prove to be virulent. Out of 27 rabbits inoculated with fresh brains containing Negri bodies three remained unaffected. BOUFFARD likewise noted a proportion of refractory animals of one in six. It may be that the native West African virus is capable of becoming exalted in certain circumstances. One virus examined by the author showed no tendency to assume a so-called "fixed" character, a fact already remarked upon by BOUFFARD in the Sudan.

EQUINE INFECTIOUS ANAEMIA.—The following letter has been received from the Director of Quarantine, Commonwealth of Australia:

Melbourne,
28th August, 1918.

Dear Sir,

I desire to invite your attention to an article which appeared in Volume 5, Number 4, Page 257 of the "Tropical Veterinary Bulletin," December, 1917, under the heading "Diseases due to Filterable Viruses," in which a report by Sohns (J.C.F.) and Soetedjo (Raden) on an outbreak of Equine Infectious Anaemia in Dutch East Indies, is reviewed. From the article it appears that the investigators of the outbreak hold that Australian horses are responsible for the occurrence of the disease, and it is stated that the disease "is believed to have been imported undoubtedly from Australia."

2. Full inquiries have been made from the State Veterinary Authorities in all the Australian States, and the official records have been searched with the view of ascertaining whether the disease has ever occurred in Australia. These inquiries have made it perfectly clear that Equine Infectious Anaemia does not, and has never existed in Australia.

3. As the statement ,if allowed to go unchallenged, is likely to prejudice the export trade of horses from Australia, I should be glad if you would kindly publish a statement to the above effect.

Yours faithfully,
(Signed) J. H. L. CUMPSTON, M.D.,
Director of Quarantine.

The Editor,
Tropical Diseases Bulletin.

MISCELLANEOUS.

SELLARDS (Andrew Watson). **Investigations of Tropical Sunlight, with Special Reference to Photodynamic Action.**—*Jl. Med. Res.* 1918. July. Vol. 38. No. 3. pp. 293–334.

The following is the author's summary :—

"The discovery by Raab in 1898 of photodynamic action has given considerable impetus to the study of biological effects of sunlight. Although many of the fundamental conditions of photodynamic action have been worked out, the phenomenon has not yet been accurately defined. It is, however, easy to give a simple illustration. Very many fluorescent substances, such as eosin, chlorophyll, or several of the blood pigments, are capable of dissolving red blood cells in the sunlight under conditions in which no hemolysis occurs in total darkness. Photodynamic action is associated closely, though perhaps not invariably with the property of fluorescence. Phenomena analogous to those occurring in vitro can be produced in animals, many fluorescent substances being toxic for animals kept in the light, but not for those in total darkness.

"Certain clinical effects have been attributed to this action of light intensified by fluorescent substances. In buckwheat poisoning, some of the symptoms ordinarily ascribed to anaphylaxis are attributed by European authorities to photodynamic action. Some of the diseases of man, notably pellagra, are considered to be instances of photosensitization, i.e., that fluorescent substances ingested with the food subsequently, with the aid of light, produce toxic effects. The therapeutic action of some drugs, notably quinine, has been ascribed to fluorescent action. However, the therapeutic effects of direct sunlight have not been definitely improved by the use of fluorescent substances.

"The toxic effects described for buckwheat, corn and other grains might be of primary importance in studies of nutrition, except for the fact that many highly photodynamic substances do not exhibit toxic effects when ingested in the alimentary tract. The symptoms occurring in various "deficiency diseases" are ordinarily interpreted as being due to a lack of dietary factors essential for normal nutrition. In addition to the effect of a deficient nutrition the possibility of toxic action is introduced in the conception of photodynamic action. Fortunately, many of the important feeding experiments on lower animals have been conducted in dull, diffuse light, a condition in which the action of light would hardly affect the general fundamental conclusions.

"Several phases of the effects of light and of photodynamic action were studied in the tropics at Santa Marta, Colombia. Confirmation was readily obtained of the photodynamic action of eosin on red cells in vitro. A similar effect could not be obtained with quinine. A trace of hemolysis was obtained by the action of sunlight alone without the aid of fluorescent substances. Complement, though readily destroyed by direct sunlight, was apparently uninjured by the diffuse light of the laboratory. Malarial parasites in defibrinated blood were not affected by exposure to direct sunlight. Diffuse light, however, exerted some deleterious action on *E. histolytica.*

"Anaphylaxis of guinea-pigs to horse serum was studied rather extensively. Typical fatal effects were obtained in animals kept in total darkness. Quantitative results, however, suggested the possibility that exposure to light during the period of sensitization may increase slightly the susceptibility of the animals. Similar results were obtained in the study of local anaphylaxis.

"No evidence was obtained, either from experiments in vitro or in vivo, that the therapeutic effect of quinine in malaria is dependent on its fluorescence, i.e., that quinine is effective only in the presence of light.

"A preparation of bilirubin was tested and found to act photodynamically in vitro in producing hemolysis and in the prevention of the clotting of blood.

"In conclusion, there are certain features which it might be well to emphasize. Photodynamic action in vitro constitutes a remarkable phenomenon, the explanation of which is perplexing and obscure; some of the cardinal features are still in dispute. There is even a possibility that undue emphasis has been laid upon the association of fluorescence with photodynamic action. The phenomenon is of very general interest since its effects may be studied not only in many distinct ways, but in several different fields of work, such as bacteriology, protozoölogy, immunology, and organic and inorganic chemistry. Indeed, a knowledge of photodynamic action is essential in certain fields of work; to a limited extent, the question of the possible effect of light is reopened in some instances where it had been taken for granted that ordinary diffuse light could exert no action.

"In contrast to the multiplicity of effects observed in vitro it is often difficult even experimentally to demonstrate photodynamic action in the animal body. It is by no means thoroughly established that sensitization to light in a photodynamic sense occurs spontaneously, even in the lower animals. As yet there is very little evidence indeed that such sensitization plays any significant part, either in the etiology or therapy of the diseases of man. The subject, however, is comparatively undeveloped, and certainly merits further effort. The field is not one which would yield at all readily results of first importance. Indeed, it is not yet clear from what general direction one might expect significant developments."

HECKENROTH (F.). **Trois observations d'une affection non classée du chien au Sénégal.** [Three Observations on an Unclassified Disease of the Dog in Senegal.]—*Ann. Inst. Pasteur,* 1918. Aug. Vol. 32. No. 8. pp. 399–405.

In this article the author describes five cases of a disease in dogs from the Kaolack and Rufisque districts of Senegal which came under his observation in 1916. Three of these animals were kept under observation at his laboratory after having been bitten in these districts. In all five cases the disease was fatal and lasted from 3 to 27 days after the appearance of first symptoms. The disease became manifest at first by a strange appearance of the animal and paralytic symptoms, more or less marked in the case of the limbs and accompanied with muscular contraction. In the case of one dog there was no apparent paralysis, the animal assuming a sitting position two hours before death. In two cases there was abundant salivation and in two cases in which the disease developed slowly the nervous symptoms appeared to become less accentuated several times for a few hours or a few days and the general condition meanwhile improved. The animal seemed to be able to feed up to a very advanced stage of the disease.

It was not possible to say whether the infection was contagious—transmitted by a biting fly or merely by the bite of another affected animal. The last-named method of infection appeared to have taken place in the case of two dogs from Rufisque which developed symptoms 15 days after having been bitten.

Laboratory examinations, carried out in order to ascertain the presence of rabies, gave no positive evidence whatever on this point. Negri bodies were not discoverable in the hippocampi of four dogs examined. In paralytic rabies, however, it is not rare to find them altogether absent from this part of the brain and they must be looked for in the spinal cord and its ganglia. This method of examination was adopted in the case of one dog from Rufisque and in the nerve cells of the posterior root ganglia of this animal there were cellular inclusions coloured deeply red by Baschieri's method. Whether these bodies were so-called spherulae described by ATHIAS (1905) and CESA BIANCHI (1907) in the dog, rabbit, and guinea-pig or minute Negri bodies requires further investigation.

Three rabbits out of four inoculated with emulsion of brain from affected dogs died. Two monkeys which were bitten in the laboratory by affected dogs showed no abnormality after more than eight months observation.

STOCKMAN (Stewart). **Louping-Ill.**—*Jl. Comp. Path. & Therap.* 1918. Sept. Vol. 31. Pt. 3. pp. 137–193. With 10 text figs.

Although this article is not concerned with a tropical disease an extract is here inserted. It is of great general interest inasmuch as an obscure ovine affection has been proved to be transmitted by the agency of ticks and caused by organisms probably of a protozoan nature, and thus it falls into line with a class of diseases hitherto considered to be pre-eminently peculiar to warm climates.

In a previous article (*Jl. Comp. Path. & Therap.*, Vol. 29, p. 24) the author dealt mainly with the suggestion that ticks might play some part in producing louping-ill, and a very considerable series of experiments with ticks from affected sheep in different stages of their life cycle was recorded. All had apparently negative results but as there appeared to be strong indirect evidence that the disease was tick-borne a further carefully planned and carried out series of investigations was conducted. At the time of the preliminary experiments the only symptom regarded as typical of louping-ill was that of paralysis. Temperatures were not taken. On the other hand as visible symptoms were absent in all cases the experiments were probably negative and hence it remained to investigate further problems in connection with possible tick transmission. The author then proceeds to discuss in detail his observations regarding the symptomatology, post-mortem lesions, and experimental transmission of the disease. His conclusions are set forth as follows:—

"(1) In investigating a disease like louping-ill, the symptoms of which in naturally contracted cases may vary from those of indisposition to those of serious illness with fatal paralysis or coma, the milder form being much the more common, the experimental results must vary in the same way. It is therefore only by taking these results as a whole, and by being able to concatenate them with each other and with what occurs under natural conditions, that conclusions can be arrived at.

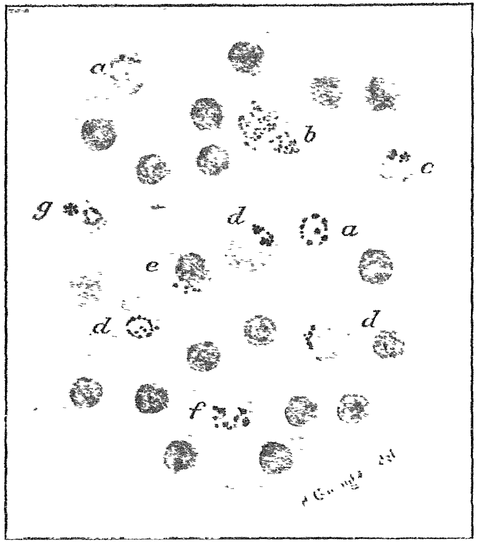

Fig. 1.

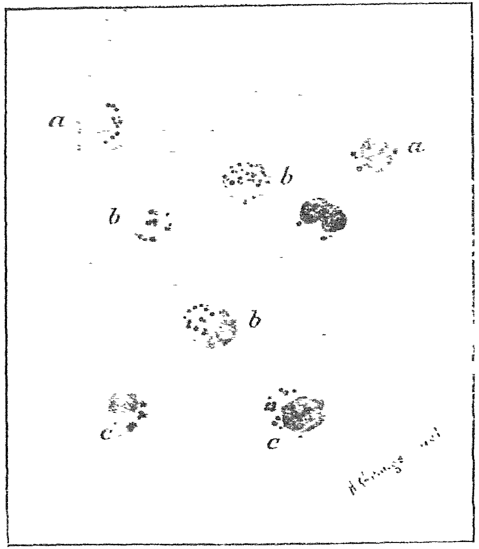

Fig. 2.

Fig. 1. Smear from œdematous lymph gland from Ewe 14288 (natural case, Experiment LXI). Stain Giemsa, + 600. *a.* Large and small chromatin bodies surrounded by blue-staining protoplasm. Appearance of division. *b.* Larger bodies of same kind containing a large number of chromatin bodies, some of which are bacillary. *c.* Chromatin bodies in small mononuclear cell. They are lying in a clear space, giving an appearance of being encysted. *d.* Chromatin bodies in large mononuclear cells. Notice the ring-like arrangement of the bodies around a clear space in the cell nearest the left. *e.* Small chromatin bodies in cell protoplasm and nucleus. *f.* Large and small chromatin bodies in large mononuclear cell. The nucleus has been partially destroyed. *g.* Rosette form and more open form.

Fig. 2. Blood smear from Wether 442 (experimental case, Experiment XC). Stain Giemsa, + 600. *a.* Large mononuclears showing small chromatin bodies in cell protoplasm. *b.* Chromatin bodies in nucleus. *c.* Larger chromatin bodies grouped in cell protoplasm.

[Reproduced by permission from the *Journal of Comparative Pathology and Therapeutics.*]

"(2) The juice of certain oedematous lymph glands and the blood from sheep affected with louping-ill when inoculated into other sheep can cause a disease which may be fatal or may amount only to an indisposition. This disease is characterised by high temperature, in some cases by coma, nervous tremblings or twitchings, or even paralysis, by an absence of macroscopic lesions capable of explaining the symptoms, and by the presence of microscopic lesions in the brain and cord of varying degree but referable to a pathological condition describable as myelo-encephalitis and similar to what are found in cases of naturally contracted louping-ill.

"(3) Notwithstanding the first apparently negative results obtained with ticks (*I. ricinus*) in various stages which had in a previous stage fed on sheep affected with louping-ill in the field (previous article), it follows from the later results . . . that larvae from females which as adults engorged on affected sheep can give rise, as in (2), to a highly febrile and sometimes fatal disease in other sheep, when put to feed upon them in very large numbers, and that adults fed as nymphs on affected sheep may have the same effect. It is possible that the apparently negative results recorded in the first article arose owing to the circumstance that only a small proportion of ticks become carriers of infection, but it is also probable that neglecting to take temperatures explains some of the apparently negative results.

"(4) The blood and the juice of oedematous lymph glands from cases arising from experimental inoculation as stated in (2) and from infestation by ticks as stated in (3) can cause similar symptoms and lesions when inoculated to other sheep in series. Ticks allowed to engorge on these experimental cases during the reaction can, after moulting to their next stage, cause the disease in other sheep upon which they are put to feed.

"(5) It follows from (3) that the infective agent, whatever it is, can be transmitted from the female ticks through the eggs to the next generation of larvae; but, although the positive results so far have been obtained with larvae and adults, it does not follow conclusively from the results available that the ticks in their nymphal stage cannot also transmit the disease.

"(6) Since the disease can be transmitted to sheep in series by inoculation it follows that the infecting agent is not a toxin, but a living agent capable of reproducing itself to some extent in the tissues of the animal into which it is inoculated. It also follows almost certainly from the fact of ticks transmitting the infection that the infective agent is a protozoan parasite. Some of the mononuclear leucocytes in oedematous glands and in the blood stream when treated by Giemsa's stain show in their protoplasm chromatin bodies which have some of the characteristics of protozoan parasites, including their staining reaction. It is not claimed, however, that a final statement can be made that these chromatin bodies are parasites, and the causal agent of louping-ill. Awaiting the results of further research on this special question, it is allowable to summarise the evidence in favour of the parasite view being correct: (1) The disease is tick-borne. (ii) Inoculation with the fluids and organs of sheep containing the bodies reproduces the disease. (iii) The bodies stain after the manner of such parasites. (iv) The causal agent is apparently not ultra-microscopic, and the bodies are the only abnormal objects observable under the microscope in materials which convey the disease by inoculation. (v) The virulent material, if perfectly fresh, is sterile as regards bacteria (the infective agent appears to be retained by bacterial filters, which is evidence that it is not ultra-microscopic).

"(7) The blood of a sheep which has recovered from the disease produced by inoculation does not continue to be infective by inoculation to others as in the case of piroplasmosis (redwater), and it is therefore unlikely that ticks can infect themselves from such animals. The same is true of material taken from a chronic case of louping-ill contracted by natural infection.

"(8) A sheep which has passed through a reaction following upon inoculation is protected to a very considerable extent against the effects of a subsequent inoculation, just as a sheep recovered from louping-ill in the field is highly resistant to further attacks. A small number of sheep which had been inoculated at the laboratory with blood survived exposure in the following season on louping-ill infected pasture, while four out of twelve (33·3 per cent.) other sheep not so inoculated, and exposed on the same pasture, died of typical louping-ill.

"(9) The blood of healthy sheep when inoculated in large amount to other sheep does not cause a reaction.

"(10) The disease which has been produced experimentally by larval ticks (*I. ricinus*) from females off sheep affected with louping-ill, and by adults which had fed as nymphs on infected sheep, and by the inoculation of gland juice and blood from such sheep, is, in fact, louping-ill. To conclude otherwise would involve the following further conclusions which are very difficult of acceptance:—

"(a) That the experimentally produced cases with conclusive symptoms and lesions . . . must be disregarded.

"(b) That there is a disease of sheep other than louping-ill, characterised by similar microscopic lesions and by similar varying symptoms, which is tick-borne and inoculable, and that sheep suffering from acute and typical louping-ill in the field are invariably attacked at the same time by this other disease, since inoculation of their gland juice or blood constantly produces it."

Inasmuch as the author considers the nature of louping-ill to have been thus established he proceeds to discuss the prospects of measures to cure, prevent, or eradicate the disease. Experiments in order to test the value of drug treatment, mostly with arsenical compounds, invariably proved unsuccessful. Work is in progress in order to determine the curative properties of an anti-serum, but no great hopes are entertained in this direction. Preventive inoculation with the blood of affected animals is said to have promising possibilities, and arrangements are being made to have it tested in practice. Investigations into the value of measures for the eradication of ticks are also contemplated either through the possibility of starving them out, allowing them to cleanse themselves by feeding on insusceptible animals, or by dipping of hosts.

Meniaud (Jacques). **Les chevaux du Haut-Sénégal et Niger.** [The Horses of Upper Senegal and Niger.]—*La Vie Agric. et Rur.* 1918. Apr. 6. Vol. 8. No. 14. pp. 241–246.

In an article previously contributed to the above journal the author dealt with the resources of French Upper Senegal and Niger in horses (over 100,000), the origins of the various breeds, and the methods of horse breeding and feeding adopted by the natives. In this article the author continues his description of the equine population dealing particularly with the work the animals are put to, the commercial side of the problem, and the efforts of the French authorities and more enlightened individuals at improving the breeds. A fairly good appreciation of the diseases of horses in these territories is given.

From the point of view of general health the condition of the horses appears to diminish with decreasing altitude, with the exception that certain plateaux situated at some distance from the border of the Niger and other rivers afford quite good conditions for breeding. The horses survive but lose all their energy in regions with a humid atmosphere or with damp pastures soaked by long continued rains and floods, and in such districts slight degrees of injury or sickness are liable to terminate fatally. On the other hand, in the north, in the Sahel, South Sahara, and Azben country, the animals recover spontaneously from quite serious diseases on account of the atmospheric dryness and bright sunlight. It was also to be noted that in the south the native population is less versed in the care of sick animals than the Moors and other tribes of the north.

Among the diseases which cause very serious losses particular mention must be made of tetanus, which is especially frequent in the regions of Zinder, Mopti, and the circles of Sikasso and Bobo-Dioulasso, where it is known to the natives as *diarani.*

The most serious drawbacks to horse breeding, however, are undoubtedly epizootic diseases,--lymphangitis, trypanosomiases, glanders, and a condition named by the author typho-malaria. The trypanosomiases are by far the most formidable of these diseases and horses in whole tracts of country are thereby decimated towards the end of the rainy seasons. The different species of Glossina known in French West Africa (*palpalis, tachinoides, longipalpis*) are not capable of harbouring the different trypanosomes to the same degree; for example, Bouet and Roubaud found that the causal organism of *baléri* was transmissible particularly by means of *longipalpis,* much less by *tachinoides,* and to hardly any extent by *palpalis.* According to Bouffard it is *G. palpalis* which predominates in Upper Senegal and Niger and the few *tachinoides* encountered are everywhere mixed with the *palpalis*; and thus unfortunately, he states, the tsetse fly capable of transmitting the most trypanosomiases is most prevalent in the Colony. Besides acting as the host of *T. gambiense,* the causal organism of sleeping sickness, it develops *T. cazalboui,* the organism of *souma, T. pecaudi,* the organism of *baléri,* and *T. dimorphon,* which is fairly rare in the Colony and is found more especially in Casamance, Guinea, and the Ivory Coast.

The tsetse flies do not appear to exist above the 14° N. parallel. Below this latitude the covered water courses with thickly wooded banks are nearly all inhabited by Glossina. The most important of these streams are the Niger, Bani, Bakoy, Bafing, and Falémé at their sources and their tributaries at their upper parts. *T. gambiense* has not been encountered throughout the whole of this fly district though it has been discovered in a few other places, but all the fly areas enumerated are stated to be foci of animal trypanosomiases affecting especially equines and certain bovines. *T. cazalboui* appears to be the pathogenic organism most commonly harboured by *G. palpalis* and *tachinoides* in the basins of the Niger, Bani, Volta Rivers, Upper Senegal and Falémé, but it is stated that Gambian horse sickness and dourine also exist in the Koury region; the symptoms of the last-named disease are often mistaken for those of *souma.* Various diseases with similar symptoms known to breeders on the borders of the Niger as *zanuri* are also most probably one or other of the before mentioned trypanosomiases.

The author again brings forward evidence to show that tsetse flies are not the only vectors of animal trypanosomiases in Africa and other biting flies such as stomoxyds and tabanids are capable of acting as transmitters. The spread of trypanosomiases among a lot of healthy horses in districts situated at some distance from tsetse areas was seen to occur after the introduction of an animal that had contracted the disease in the tsetse areas. Moreover, *souma* causes great losses at some distance north of 14° N. lat.; the disease is being continuously imported into these healthy areas from the fly areas further south and then transmitted locally by species of flies other than tsetse. The treatment adopted by the natives in cases of *souma* consists in providing the sick animal with good nourishment and tonics after preliminary adminstration of purgatives and diuretics.

REPORTS.

ASSAM. **Report of the Civil Veterinary Department for the Year 1917-1918.** 1918. 14 pp. f'cap. Shillong: Assam Secretariat Ptg. Office. [Price 8 annas or 8*d.*]

The substance of this report dealing mainly with statistics is well summarised in the Resolution appended by the Chief Secretary to the Chief Commissioner of Assam as follows :—

> "The staff of the department was strengthened during the year by the addition of 4 new assistants and at the close of the year the staff available for local service consisted of 3 Inspectors and 36 Assistants. Five Veterinary Assistants were on deputation to military duty, and there are 20 stipendiaries in the Bengal Veterinary College.
>
> "The number of deaths from contagious disease reported was 60,710, an increase of nearly 13,000 over the numbers of the preceding year and more than double those of 1913-14, since when the deaths reported have increased year by year. The increase is attributable largely to improved reporting, but there was a quite exceptional epidemic of rinderpest during the year in Goalpara. This single epidemic is said to have caused 14,294 deaths. Unfortunately in very few instances were reports of the outbreaks in that district received in time for preventive inoculation to be undertaken. The special attention of the veterinary and district officers is being drawn to this failure of the system of reporting. In the province as a whole there was a satisfactory increase in the number of inoculations against rinderpest, anthrax, and haemorrhagic septicaemia. The number rose from 36,016 to 45,704, and among the 38,295 animals inoculated for rinderpest, only 346 or 0·9 per cent. died.
>
> "The number of villages visited and of animals treated by assistants on tour shows a decrease, of which no explanation has been furnished. The Chief Commissioner desires that in future explanations may be given of such important variations in figures.
>
> "The question of the improvement of local breeds of cattle engaged the attention of the Chief Commissioner, and the Government of Bengal have been asked whether they will be able to supply this Administration with a few bulls for breeding purposes from the Rangpur Farm in Bengal.
>
> "The Superintendent has drawn attention to the importance, when circumstances permit, of sending a number of Veterinary Assistants to the Veterinary College for a course of post-graduate training. The Chief Commissioner recognises that such a course of training is very desirable in the case of assistants who, owing to the isolation of their stations or for other reasons, are unable to keep their professional knowledge up to date. In order to give effect to the Superintendent's suggestion a definite scheme should be submitted by the Director of Land Records and Agriculture." . . .

BIHAR & ORISSA. **Annual Report of the Civil Veterinary Department for the Year 1917-18.** 1918. 8+xiv+2 pp. f'cap. With 1 chart. Patna: Supt. Govt. Ptg. [Price 8 annas or 8*d.*]

This report first deals with veterinary instruction. As in previous years condidates for the veterinary service were few and ill-qualified. According to the secretary to the Government the conditions in respect of pay are not at present satisfactory, but proposals for their improvement have been submitted to the Government of India.

In horses the only ascertained cases of contagious disease were two of surra.

In bovines rinderpest, foot-and-mouth disease, and haemorrhagic septicaemia were very prevalent. The mortality from the last-named disease was very high (5,584 out of 7,018 affected). Outbreaks of blackwater and anthrax were also reported from some districts. Rinderpest was not so violent as in the preceding year but caused considerable mortality in Ranchi, Palamau, Gaya, Monghyr, and Cuttack. In the last district it is stated that the efforts of the Department were hampered by opposition based on local religious sentiments, which are not likely to disappear until education is more widely diffused The district of Shahabad which suffered severely in the previous year was practically free from the disease. The total number of outbreaks attended by veterinary assistants fell off considerably and this is attributed to bad communications, heavy rains, and absence of a considerable number of the staff. The apparent increase in the prevalence of foot-and-mouth disease is said to be largely due to more efficient reporting (77,895 animals affected, 1,041 died). Details are given regarding inoculations practised against rinderpest, haemorrhagic septicaemia, anthrax, and blackquarter. Inoculation fell off by about 10,000 cases.

CEYLON. **Administration Reports for 1917. Report of the Government Veterinary Surgeon** [STURGESS, G. W.]—6 pp. f'cap.

Infectious diseases.—Rinderpest occurred in six provinces and three remained free. The total number of cases for the year was 2,076, against 856 in the preceding year. The increase was chiefly due to a somewhat extensive outbreak in the town of Colombo—806 cases. There was a great increase in the number of cases of foot-and-mouth disease during the year and all provinces were affected. The total number of cases was 7,132 against 284 in the preceding year. The disease was of a very mild type only 94 deaths being reported. The number of cases of anthrax outside Colombo was 62. In the town six cases occurred, and in the quarantine station 472 cases among goats and sheep imported from South India, the disease being very prevalent among these animals during shipment. Rabies was more prevalent than usual during the year, especially in Colombo town. Forty two cases were examined at the bacteriological institute, of which 25 gave positive and 17 negative results. A few cases of infection by *P. bigeminum* were reported from time to time, especially amongst imported European cattle. No cases of surra were reported. In June two cattle died in Uva of eating rubber leaves, a ball of leaves and coagulated rubber being found in the throat on post-mortem examination. There were no further cases of swine septicaemia reported.

There was no outbreak of infectious disease among horses during the year. The disease which caused most loss amongst these animals was osteoporosis. A considerable amount of work is stated to have been done in the laboratory upon this disease during the year. The investigations were directed to ascertaining whether the small micrococcus, reported by CAROUGEAU, in Madagascar, or whether the nematode worms (*Cylicostomum tetracanthum*) found in the caecum and colon as stated by CONREUR in Brazil, had any relationship with the disease. The results were all negative.

The incidence of the above diseases in the various provinces is then tabulated. The total number of cattle and buffaloes in the Island was 1,620,768. Two hundred and thirty cattle exposed to rinderpest infection were inoculated with anti-serum; 188 remained free, 42 became ill within a month, and of these 17 recovered and 25 died. A number of statistical returns dealing with the importation of livestock, quarantine measures, rabies, and the Government Dairy and Model Farm are then given.

GOLD COAST. **Report on the Veterinary Department for the Year 1917.** [McDOUALL, J. C., Acting Veterinary Officer.] 1918. 5 pp. f'cap. Accra: Goverment Press.

All cattle arriving at Coomassie were inspected and of these 26 were detained as they showed suspicious symptoms of contagious disease. Four of these animals died during detention and 22 were slaughtered. All are said to have exhibited definite post-mortem lesions of rinderpest. This disease is said to be still active in the Northern Territories and French country and spread by owners taking infected cattle where they may be safe from inspection by a Government official, thus infecting new areas. Statistics are given with regard to the exportation and importation of live stock from Coomassie during the year. Scabies appears to have been very prevalent in dogs, sheep, and goats in Commassie town. The herd at the Livestock Farm, Coomassie was in a healthy state.

MADRAS PRESIDENCY. **Annual Administration Report of the Civil Veterinary Department for 1916-1917.** 1917. 22 pp. f'cap. With 1 map. Madras: Superintendent Govt. Press. [Price 8 annas or 9*d.*]

This report comprises the Annual Report of the Superintendent Civil Veterinary Department, Madras, and the Annual Report of the Madras Veterinary College. The bulk of the report deals with statistics.

There was an increase in the number of contagious diseases under every head as compared with the previous year (68,588 against 57,472). No glanders or dourine was reported, 16 cases of surra were diagnosed, 8 cases of piroplasmosis in cattle and one in the horse were confirmed, 58 cases of the equine disease known as kumri were diagnosed at the different hospitals. 26,215 deaths from rinderpest were reported as against 22,268 in the previous year. The Guntúr district suffered most. The double inoculations performed against this disease numbered 100,463 against 90,898 in the previous year. 7,900 deaths from anthrax and 8,635 from haemorrhagic septicaemia were reported. Blackquarter caused 6,927 deaths and foot-and-mouth disease 2,637 deaths. It is stated that the skinning of carcases of animals dead of contagious diseases and the throwing of carcases into the rivers by natives are important factors in the spread of contagion.

MAURITIUS. **Annual Report on the Department of Agriculture for 1917. Annexure 3. Report on the Work of the Veterinary Division.** [LIONNET, F. E., Veterinary Surgeon.] pp. 12–13 f'cap.

During the year surra was detected in mules on a number of estates. Animals on these estates were placed in quarantine and soamin and arsenic treatment employed. The results obtained are stated to have been successful; the experiments were apparently controlled. Two mules treated by Laveran's method relapsed five times and finally recovered after eight months. Several outbreaks of foot-and-mouth disease occurred during the year. Two fatal cases of piroplasmosis were reported in milch cows. Epizootic lymphangitis was detected in a sandalwood pony. A contagious disease of undetermined nature occurred among sheep. Two cases of tuberculosis were detected in the abattoir. The importance and necessity of dipping tanks is getting more known and appreciated in the Colony; many estates have already constructed tanks and have obtained satisfactory results. It is held that this will prove a great step forward towards improvement in breeding cattle, especially in districts where ticks are abundant.

MUKTESAR LABORATORIES. **Annual Report of the Director and First Bacteriologist** [SHEATHER, A. Leslie] **for the Year ending 31st March 1918.**—MS. 18 pp. f'cap. With 2 tables.

A brief account is first given with regard to the administration of the establishment including arrangements made for fodder and grain supply, forests, and water supply, electric centrifuges, supply of hill bulls and plains animals, the Bareilly branch laboratory, and tours of investigation undertaken. The Second Bacteriologist (SHILSTON, A. A.) was employed in Mesopotamia from the months of June to October. To meet the increasing demands for anti-rinderpest serum it was found necessary to open the branch laboratory at Bareilly during the winter months, and maintain between 150 and 200 serum animals there. The work of the laboratory was seriously interfered with on account of two outbreaks of relapsing fever among the coolies and gwallas.

Preparation of serums and vaccines.—A considerably increased quantity of anti-rinderpest serum, now amounting to over 2,000,000 doses, was manufactured and issued as compared with the preceding year. There was a decreased demand for anthrax serum and hence a smaller quantity was manufactured. An increased quantity of haemorrhagic septicaemia serum (216,457 doses prepared, 189,428 doses issued) was prepared. The quantity of vaccine prepared against this disease showed a slight decrease. No necessity arose for manufacturing an additional quantity of blackquarter vaccine as the demands (17,324 doses) were complied with from stock in hand. The demand for mallein was very excessive (193,147 doses issued as against 35,972 in the preceding year). An increased quantity of tuberculin was also manufactured. Strangles serum and vaccine and miscellaneous vaccines were prepared as in previous years. The following Table shows the main results obtained by the use of these vaccines.

A number of interesting specimens were examined at the laboratory. Owing to the deputation of the Second Bacteriologist to Mesopotamia

TABLE.

	Number of outbreaks in which inoculation was undertaken	Number of animals which died uninoculated in course of disease.			Number of animals inoculated.			Number of animals which died after inoculation.			Percentage of deaths in inoculated bovines
		Equines.	Bovines.	Others.	Equines.	Bovines.	Others.	Equines.	Bovines.	Others.	
Anti-rinderpest serum	3,972	—	67,491	95	—	495,117	709	—	1,936	4	0·39
Anthrax serum ..	106	25	1,457	4	571	9,911	184	—	29	—	0·29
Haemorrhagic septicaemia serum	1,094	1	8,918	77	20	130,322	794	1	133	—	0·10
Haemorrhagic septicaemia vaccine	235	—	296	—	—	50,406	—	—	9	—	0·01
Blackquarter vaccine	95	—	166			9,435	—	—	40	—	0·42

work in connection with the serum test in the diagnosis of dourine was greatly interrupted. By this test 11 cases proved to be positive, 11 doubtful, and 201 negative. Details are added concerning inoculations at the Military Dairy, which included imported Ayrshire bulls inoculated against piroplasmosis and rinderpest. Unfortunately foot-and-mouth disease broke out while these inoculations were in progress with the result that some animals suffered severely from both this disease and rinderpest.

Research.- Shortness of staff and increase in routine and administrative duties seriously limited the time that could be given to research work. The question of the vitality of the virus of rinderpest under varying conditions is still under investigation and a special series of experiments is being carried out with the object of ascertaining the length of time during which hides removed from animals dead of rinderpest remain infective. The modifications in the manufacture of anthrax and haemorrhagic septicaemia sera, foreshadowed in last year's report [see this *Bulletin*, Vol, 5, No. 1, p. 67], have been effected and resulted in a very distinct reduction in the mortality among the serum making animals and also in a saving of labour. The question as to the length of time hides of animals dead of haemorrhagic septicaemia remain infective is also under investigation.

A number of attempts were made to isolate the organism responsible for abortion of cattle but all failed owing to the presence of numerous contaminating organisms in the materials sent to the laboratory. A strain of the organism was obtained from England and a number of tests are now being carried out with regard to the disease but the number is stated to be too small to warrant any definite opinion; the results, however, appear to indicate that the same bacillus is responsible for the disease in India. In last year's report a reference was made to the occurrence of Johne's disease among cattle in India. Two cattle kept under observation were proved on post-mortem examination to have been undoubtedly affected with this disease. Buffaloes placed in contact with the above animals have hitherto shown no sign of having become infected. The disease was also diagnosed in the viscera of two animals obtained from Poona.

A number of strains of tubercle bacilli from bovine lesions have been isolated and these are being studied.

Pleuro-pneumonia of goats was also the subject of experimental work and a quantity of material from a natural case of the disease was received. Unfortunately pneumonia of a different type broke out among the animals selected for experiment and it was found impossible to use the material available with any hope of getting reliable results.

In the tables appended data are given with regard to the doses of the various products issued and the main results of the working of the laboratory.

NIGERIA. Annual Report on the Agricultural Department, Northern Provinces, for the Year 1916. Appendix I. Revision of Veterinary Report for the Year 1916. [BRANDT, F. R., Chief Veterinary Officer.]—pp. 7–10 f'cap.

In July 1916 a number of rules were drawn up for adoption by the native administration to control the spread of contagious disease.

There appears to be no doubt that rinderpest has been enzootic in Nigeria for years. Twenty one outbreaks were reported in which the mortality amounted to 40 per cent. The methods of dealing with outbreaks have been those of segregation and isolation of diseased animals. The disease was nearly always too far advanced when first reported to warrant inoculation with anti-rinderpest serum. Pleuro-pneumonia is widespread throughout the country. Forty-one outbreaks were reported and no doubt many others occurred. The measures of isolation of sick and segregation of infected herds were adopted. Slaughter of all diseased animals and compensation to owners has been strongly advised. The setting aside of large areas in each province solely for the use of pleuro-pneumonia herds had been advocated and endeavours are now being made to select such areas. The natives of West and East Africa have for years practised a method of inoculation in which a piece of diseased lung is inserted beneath the skin of the face of a susceptible animal. Native preparation of the virulent material varies, in some parts the liquid virus is used mixed with milk, in others the diseased lung is buried until putrefaction takes place and in others it is mixed with ashes. The local effects of inoculation with such material are severe and many deaths result, but nevertheless the method appears to have a marked effect in curtailing an outbreak and conferring immunity on many of the animals.

Trypanosomiasis appears to be very prevalent in the southern part of the Northern Provinces, and the trypanosomes vary considerably in virulence. Measures are being adopted for preventing movement of cattle by nomad tribes.

RANGOON MUNICIPALITY. **Report on the Working of the Veterinary Department for the Year 1917-18.** [BLAKE, A., Veterinary Officer.]—1918. 7 pp. f'cap. Rangoon: British Burma Press.

Since the year 1910 a serious effort has been made to eradicate glanders which had become very prevalent amongst the horses of Rangoon. During that year 506 animals were destroyed and 296 were definitely ascertained post-portem to have been affected with the disease. In the year under report the number had decreased to two clinical cases and four reactors to mallein. One case of epizootic lymphangitis was detected. There were no cases of surra. Anthrax affected 5 horses, 15 cattle, and 1 goat. The Municipality suffered in the year under report the worst visitation of rinderpest during the last 25 years. Eight cases of rabies were diagnosed. Statistics are given regarding the abattoirs, cattle market, and other duties under the supervision of the veterinary officer.

UNITED PROVINCES, INDIA. **Annual Report on the Civil Veterinary Department for the Year ending 31st March 1918.**—pp. 22 f'cap. Allahabad: Supt. Govt. Press. 1918. [Price 8 annas or 9*d*.]

During the year under review the reported mortality from various contagious diseases was 17,407. The increase over the preceeding year was chiefly due to the extension of the prevalence of surra and to severe outbreaks of foot-and-mouth disease, haemorrhagic septicaemia, blackquarter, and anthrax.

Equines.—Forty two cases of glanders and farcy were detected during the year in nine districts. It assumed a severe form in the dak line between Dehra Dun and Rajpur. As usual surra made its appearance in the tracks along the foot of the hills but outbreaks in a severe form occurred in the districts of Etawah, Mainpuri, Banda and Naini Tal. In the districts of Mainpuri and Banda increased numbers of the staff were delegated to deal with the outbreak and it is said that if action had not been taken to deal with the disease in time it would have caused disastrous results. Six hundred cases are known to have either succumbed or were destroyed, but there is every reason to believe that many cases occurred in outlying localities. A number of cases of tetanus, strangles, horse pox, piroplasmosis, influenza, anthrax, rabies, and diseases caused by internal and external parasites were also met with.

Bovines.—During the year under report there was a slight abatement in the ravages caused by rinderpest and many localities escaped lightly. It assumed a severe form in four districts. Inoculations were carried out in 34 districts and altogether 26,224 animals were immunised. Haemorrhagic septicaemia appeared in a specially virulent form and attacked 41 districts, resulting in a total mortality of 3,142. 21,491 head of cattle were inoculated with very satisfactory results, and it is believed that had it not been for these measures very much more severe losses would have occurred. The Provinces again suffered very severely from foot-and-mouth disease; it prevailed with greater or less intensity throughout the whole area, very few districts escaping its ravages. The reported losses from the disease were 2,854, the mortality being chiefly confined to young stock and old and weak decrepit animals. The disease, moreover, caused great inconvenience to agriculturists especially during the harvest and ploughing seasons. Cattle fairs and markets are responsible for much of its spread. The question how to deal effectively with this disease is a very serious one in a country like India owing to the large tracts of unfenced land where the cattle can wander at will and spread infection among animals with which they come in contact. Blackquarter appeared in 20 districts and caused 3,114 deaths. Vaccination was adopted as a preventive measure in some places. Anthrax occurred in 30 districts, producing a mortality of 1,687. 145 head of cattle were reported as having died from other contagious diseases, including pleuro-pneumonia, tuberculosis, contagious abortion, etc.

Amongst other animals pleuro-pneumonia and rinderpest were as usual responsible for many deaths among sheep and goats. Rabies, canine distemper, tetanus, haemorrhagic septicaemia, fowl cholera, spirochaetosis, surra, and various parasitic ailments accounted for many deaths among the smaller domesticated animals.

There was a decrease in the number of animals inoculated. Many interesting specimens of blood, morbid tissues, and other intestinal parasites were submitted to the headquarters laboratory by the subordinate staff and also by district authorities for pathological and bacteriological examination. Investigations were conducted in connection with kumri, gillar, bursati, akrah, fowl cholera, piroplasmosis, etc. The prophylactic and curative effects of distemper, tetanus, and strangles vaccine were tested. [It would be interesting to examine the published results of these important investigations —Ed.] The research and experimental station at Badshahbagh is said to fulfil a useful purpose in affording a great opportunity to the subordinate staff for the observation and study of disease and methods of research. At the request of the Director and Imperial Bacteriologist an enquiry is being made into the prevalence of Johne's Disease.

Details are next given with regard to veterinary hospitals and dispensaries, subordinate establishment, veterinary instruction, and the somewhat extensive breeding operations carried on under the supervision of the Department. According to the Superintendent it is satisfactory to be able to report that in nearly every branch of the work of the Civil Veterinary Department very satisfactory progress is still being made.

ZANZIBAR PROTECTORATE. **Annual Report Public Health Department for 1916. Veterinary Division Report for 1916.** [ADERS (W. M.).] pp. 26–31. 1917. Zanzibar.

In this report the author deals with outbreaks of trypanosomiases and East Coast Fever that had occurred among animals during the year. In a number of cases cattle in apparent good health were found to harbour trypanosomes of the *T. pecorum* type in their blood. This trypanosome is the cause of bovine trypanosomiases in Zanzibar. It is believed that this organism is transmitted by means of Tabanidae and not by Stomoxys. No tsetse fly exist in the Island. The author hopes to collect statistics dealing with the incidence and distribution of the disease in the more remote districts where gadflies are common.

ROUSSEAU (L.). **Maladies parasitaires à Douala (Cameroun).** [Parasitic Diseases at Duala, Cameroons.]—*Bull. Soc. Path. Exot.* 1918. Oct. Vol. 11. No. 8. pp. 744–759.

Animal trypanosomiases.—Ten years ago there existed two primitive humpless breeds of cattle in the district around Duala, but they have now become completely extinct as the result of a severe epizootic and also on account of the wholesale slaughter carried out at the instigation of the Germans. A number of cattle brought into the town of Duala for slaughter succumbed to a disease which on examination of the blood proved to a be trypanosomiasis. Some of the animals were attacked during the course of the journey and succumbed in from 5 or 6 to 48 hours after the first symptoms. Shortly before death they showed considerable wasting, dullness, rough coat, swelling of the extremities, slight diarrhoea, and often marked anaemia. The trypanosome showed active wriggling movements and was somewhat difficult to find in the peripheral blood. Inoculation of guinea-pigs gave negative results.

A case of trypanosomiasis was diagnosed in a horse showing symptoms of weakness and paraplegia. Microfilariae were also observed in the blood of this animal. During certain periods trypanosomiasis is said to cause heavy mortality among dogs. Tsetse flies are somewhat rare in the town and on the adjacent plateau. *G. palpalis* is of widespread distribution while *G. pallicera* and *G. fusca* were identified in certain districts.

RECENT LITERATURE.

[Continued from this *Bulletin,* Vol. 6, No. 2, pp. 129–140.]

PROTOZOAN PARASITES.

Békensky (P.). Sur les Spirochétes du tube digestif des Rongeurs [The Spirochaetes of the Intestinal Tract of Rodents.]—*Bull. Soc. Cent. Méd. Vét.,* 1918. June 20. *Rec. Méd. Vét.,* 1918. June 30. Vol. 94. No. 12. pp. 296–298.

Brug (S. L.). The Genus *Endoplasma* Castellani, 1914.—*Jl. Trop. Med. & Hyg.,* 1918. June 1. Vol. 21. No. 11. pp. 114–115. With 1 plate.

de Campos (Jose Mariano) & de Sá (Carlos Accioly). Diagnostico e tratamento da tristeza. [Diagnosis and Treatment of Bovine Redwater.]—*Rev. Vet. e Zootechnia,* 1918. Vol. 9. No. 1. pp. 16–28.

Commes (Ch.). *Haemoproteus* d'Oiseaux du Haut-Sénégal et Niger. [Haemoproteus of Birds in Upper Senegal and Niger.]—*Bull. Soc. Path. Exot.,* 1918. June. Vol. 11. No. 6. pp. 443–445.

Chatton (Edouard). La nutrition des flagellés intestinaux du genre *Trichomastix,* en cultures pures. Simplifications rationelles de la méthode de culture: Les tissus coagulés. [Nutrition of Intestinal Flagellates of the Genus Trichomastix. The Use of Coagulated Tissues as a Rational Simplification in Cultural Methods.]—*C.R. Soc. Biol.,* 1918. July 20. Vol. 81. No. 14. pp. 774–777.

—— & Blanc (Georges). Culture du trypanosome du gecko chez la punaise des lits. [Cultivation of the Trypanosome of the Gecko in the Bed Bug.]—*Bull. Soc. Path. Exot.,* 1918. May. Vol. 11. No. 5. pp. 387–391.

—— & ——, Le *Leptomonas* de la Tarente dans une région indemne de Bouton d'Orient. Observations et expériences. [Leptomonas in the Gecko (*Tarentola mauritanica*) in a Region Free from Oriental Boil.]—*Bull. Soc. Path. Exot.,* 1918. July. Vol. 11. No. 7. pp. 595–609.

Crowell (B. C.) & Haughwout (F. G.). Observations on the Incidence of Intestinal Spirochetes in the Philippine Islands.—*Jl. Infect. Dis.,* 1918. Mar. Vol. 22. No. 3. pp. 189–193. With 1 chart.

Galli-Valerio (B.). Coccidia in the Intestines—Red Dysentery of Cattle—Observations on Eimeria Zurni-Rivolta.—Abstracted in *Vet. Jl.,* 1918. June.. Vol. 74. No. 6. pp. 219–223.

Laveran (A.). Boutons d'Orient expérimentaux chez un Chimpanzé. [Oriental Boil Experimentally Produced in a Chimpanzee.]—*Bull. Soc. Path. Exot.,* 1918. July. Vol. 11. No. 7. pp. 561–562.

Léger (Marcel). Infection sanguine par *Leptomonas* chez un Saurien. [Blood Infection by Leptomonas in a Lizard.]—*C.R. Soc. Biol.,* 1918. July 20. Vol. 81. No. 14. pp. 772–774.

Railliet (A.). La coccidiose du lapin. [Coccidiosis of the Rabbit.]—*Bull. Acad. Agric.*, Paris, 1917. Nov. 7. Extracted in *Rec. Méd. Vét.*, 1918. Aug. 15–Sept. 15. Vol. 94. Nos. 15 & 17. pp. 452–453.

Sangiorgi (Giuseppe). Coccidiosi renale ed intestinale nell' uomo da *Isospora bigemina.* [Renal and Intestinal Coccidiosis in Man due to *I. b.*]—*Pathologica*, 1918. Apr. 1. Vol. 10. No. 225. pp. 73–75. With 2 figs.

Sergent (Et.). Une Hémogrégarine de *Vipera libetina* L. d'Algérie. Début de l'evolution de cette Hémogrégarine chez un Acarien. [A Haemogregarine of *V. l.* of Algeria. Commencement of its Development in an Acarid.]—*Bull. Soc. Path. Exot.*, 1918. Apr. Vol. 11. No. 4. pp. 278–281. With 25 figs

Sergent (Edm. & Et.), Foley (H.), & Lhéritier (A.). De la mortalité dans le Debab, Trypanosomiase des Dromadaires. [Mortality in *Debab*, a Trypanosomiasis of Dromedaries.]—*Bull. Soc. Path. Exot.*, 1918. July. Vol. 11. No. 7. pp. 568–570.

"I. In two carefully observed cases of naturally contracted *debab* in the dromedary, the disease proved fatal in four months. One dromedary inoculated experimentally with infected blood appeared to have recovered in 18 months.

"II. *Debab* lowers the resistance of infected dromedaries and makes them more susceptible to the effects of other infections, poor feeding and overwork. In this respect it resembles human malaria."

Schultz (C. H.). Mysterious Losses among Cattle in the Pacific Northwest. A Clinical Study.—*Jl. American Vet. Med. Assoc.*, 1918. Sept. Vol. 53. (New Series, Vol. 6.) No. 6. pp. 711–732.

The author describes the clinical manifestations in outbreaks of coccidiosis among cattle.

Velu (H.). Les troubles oculaires et locomoteurs dans la trypanosomiase des chevaux du Maroc. [Ocular and Locomotory Disturbances in Equine Trypanosomiasis in Morocco.]—*Bull. Soc. Path. Exot.*, 1918. July. Vol. 11. No. 7. pp. 566–568.

For a summary of the contents of the above paper see an extract of another paper by this author on p. 218 of this *Number*.

METAZOAN PARASITES.

Arthropods (Acari, Flies, Ticks).

Aders (W. M.) Economic Biology. Entomology in Relation to Public Health and Preventive Medicine and Veterinary Science.—*Zanzibar Protectorate Ann. Rept. Pub. Health Dept. for* 1916. pp. 32–37. 1917. Zanzibar: Govt. Printer.

Bequaert (J.). Parasitic Muscid Larvae collected from the African Elephant and the White Rhinoceros by the Congo Expedition.—*Bull. American Mus. Nat. Hist.*, 1916. Vol. 35. pp. 377–387.

Bishopp (F. C.) & Wood (H. P.). Preliminary Experiments with Sodium Fluoride and Other Insecticides against Biting and Sucking Lice.—*Psyche*, Boston, Mass., 1917. Dec. Vol. 24. No. 6. pp. 187–189.

Cameron (A. E.). Some Blood-Sucking Flies of Saskatchewan.—*Jl., American Vet. Med. Assoc.*, 1918. Aug. Vol. 53. (New Series, Vol. 6). No. 5. pp. 632–638.

Carter (Henry P.). Simple Treatment of Manure to Prevent Fly Breeding—The Panama Method.—*Proc. Med. Assoc. Isthmian Canal Zone*, 1917. Jan.–June. Vol. 10. Part 1. pp. 79–80. With 5 plates.

CARPENTER (G. H.) & POLLARD (F. J. S.). The Presence of Lateral Spiracles in the Larva of *Hypoderma.—Proc. Roy. Irish Acad.*, 1918. Apr. Vol. 34. Sect. B. No. 4. pp. 73–84. With 22 figs.

CHACARAS E QUINTHES (San Paulo), 1918. Jan. 15. Vol. 17. No. 1. pp. 13–15. Contra os Piolhos do Porco. [Against Pig Lice.]

DU TOIT (P. J.). Uber Zecken und deren Bekämpfung. [Ticks and their Control.]—*Ztschr. f. Infektionskr. d. . . . . Haustiere*, concluded 1918. Feb. & June. Vol. 19. Nos. 2 & 3. pp. 97–128. 210–241.

EWING (H. E.) & HARTZELL (Albert). The Chigger-Mites affecting Man and Domestic Animals.—*Jl. Econ. Entom.*, 1918. Apr. Vol. 11. No. 2. pp. 256–264. With 1 text-fig.

FITCH (C. P.). Animal Parasites affecting Equines.—*Jl. American Vet. Med. Assoc.*, 1918. June. Vol. 53. (New Series, Vol. 6.) No. 3. pp. 312–330.

HALL (Maurice C.). The Control of Lice on Horses, with Especial Reference to Winter Conditions.—*Vet. Jl.*, 1918. Aug. Vol. 74. No. 8. pp. 278–284.

HOLLISTER (W. L.). Parasites of Swine.—*Jl. American Vet. Med. Assoc.*, 1918. June. Vol. 53. (New Series, Vol. 6.) No. 3. pp. 330–334.

JEPSON (F. P.). Insects injurious to Man and Animals.—*Dept. Agric. Fiji, Report for the Year* 1916–1917. Nov. 20. pp. 23–25. Suva.

KNOWLES (A. D.). Parasites of Sheep.—*Jl. American Vet. Med. Assoc.*, 1918. June. Vol. 53. (New Series, Vol. 6.) No. 3. pp. 334–344.

MOTE (D. C.) Some External Parasites of Poultry.—*Ohio Agric. Exper. Stat.*, Bulletin No. 320. 1917. Dec. pp. 139–156. With 14 figs.

NEWSTEAD (R.). Polypneustic Lobes in the Larvae of Tsetse-flies (*Glossina*) and Forest-flies (*Hippoboscidae*).—*Ann. Trop. Med. & Parasit.*, 1918. July. Vol. 12. No. 1. pp. 93-107. With 7 text-figs.

PLACE (F. E.). Sheep Nasal Fly.—*Jl. Dept. Agric. South Australia*, 1917. Dec. Vol. 21. No. 5. pp. 443–444.

REIDY (J. B.). Cattle Tick Eradication.—*Texas Dept. Agric.*, Proc. 7th Meeting Texas State Farmers' Institute, 1917. Nov.-Dec. Bull. No. 57. pp. 17–23. With 1 map.

SMITH (Ernest J.). Organising and Conducting State-Wide Tick Eradication in Louisiana.—*Jl. American Vet. Med. Assoc.*, 1918. Aug. Vol. 53. (New Series, Vol. 6.) No. 5. pp. 639–645. With 7 text figs.

TAYLOR (F. H.). Australian Tabinadae, [Diptera] No. 2.—*Proc. Linnean Soc., N.S.W.*, Sydney, 1917. Apr. 4. Vol. 41. No. 164. pp. 746-762.

TETLEY (H.). The Structure of the Mouth-parts of *Pangonia longirostris* in Relation to the probable Feeding-Habits of the Species.—*Bull. Entom. Res.*, 1918. Feb. Vol. 8. Nos. 3–4. pp. 253–267. With 11 text figs.

WILHELMI (J.). Die gemeine Stechfliege (Wadenstecher); Untersuchungen ueber die Biologie der *Stomoxys calcitrans*, L. [The Common Biting-Fly; Investigations on the Biology of *Stomoxys calcitrans*.] —110 pp. With 28 figs. Berlin: Paul Parey. [Price, Mark 6.50.]

Helminths.

FRENKEL (H. S.). Distomatosis der mesenterialen Lymphdrüsen des Rindes. [Fluke Invasion of the Mesenteric Lymphatics in the Ox.]—*Ztschr. f. Infektionskr. . . . . d. Haustiere.*, 1918. Sept. Vol. 19 No. 4. pp. 384–387. With 1 text fig.

HALL (Maurice C.) & WIGDOR (Meyer). Notes on the Acanthocephalid and Arthropod Parasites of the Dog in North America.—*Jl. American Vet. Med. Assoc.*, 1918. July. Vol. 53. (New Series, Vol. 6.) No. 4. pp. 493–500.

—— & ——. Two New Flukes from the Dog.—*Jl. American Vet. Med. Assoc.*, 1918. Aug. Vol. 53. (New Series, Vol. 6.) No. 5. pp. 616–626. With 6 text figs.—*Alaria americana* and *A. michiganensis*.

—— & ——. A Physaloptera from the Dog, with a Note on the Nematode Parasites of the Dog in North America.—*Jl. American Vet. Med. Assoc.*, 1918. Sept. Vol. 53. (New Series, Vol. 6). No. 6. pp. 733–744. With 6 text figs.

HILGERMANN & WEISSENBERG (Richard). Nematodenzüchtung auf Agarplatten. [Cultivation of Nematodes on Agar Plates.]—*Cent. f. Bakt.* 1. Abt. Orig., 1918. Feb. 28. Vol. 80. No. 7. pp. 467–472.

LEGER (Marcel). Microfilaires animales en Guyane Française. [Animal Microfilariae in French Guiana.]—*Bull. Soc. Path. Exot.*, 1918. May. Vol. 11. No. 5. pp. 392–395.

LEIPER (R. T.). Is the Cat really a Definitive Host of *Dicrocoelium lanceatum?* A Note on some Flukes from British Guiana and the Malay States.—*Vet. Jl.*, 1918. Sept. Vol. 74. No. 9. pp. 327.

"On present knowledge I prefer to accept the view that (*a*) the sheep fluke does not use the cat as an alternative definitive host; (*b*) the flukes found by Mr. Bodkin [in British Guiana] and by Dr. Wellington [in the Malay States in the Cat], probably belong to a distinct species of an allied genus, viz., *Platynosomum*, and (*c*) the early record by v. Siebold, etc., of the occurrence of *Dicrocoelium lanceatum* in the cat remains still an isolated, doubtful, and unconfirmed statement."

MOUCHET (R.). Sur des lésions anatomiques produites par des Nématodes. [Anatomical Lesions Produced by Nematodes.]—*Bull. Soc. Path. Exot.*, 1918. July. Vol. 11. No. 7. pp. 573–575. With 1 plate comprising 2 figs.

a. Cysts of the intestinal wall in a leopard, caught near Lake Tanganyika, set up by *Galoncus perniciosus* Linstow, 1885. *b*. Adenomatous-like growths in the gall bladder of two rodents (*Thryonomys swinderianus* Temmink, 1827), caused by *Acheilostoma moucheti* Raill., 1918.

SEURAT (L. G.). Extension de l'habitat du *Spirura gastrophila* (Mueller).—*C.R. Soc. Biol.*, 1918. July 27. Vol. 81. No. 15. pp. 789–791.

SPARAPANI (Giuseppe Carlo). Sulla comparsa di emolisine specifiche nel siero di sangue di animali trattati con carni verminose. [Reactions of Specific Emulsion towards Blood Serum of Animals treated with Verminous Flesh.]—*Pathologica*, 1918. May 1. Vol. 10. No. 227. pp. 93–95.

Travassos (Lauro). Helmintes parasitos de animaes domesticos. [Helminths Parasitic in the Domesticated Animals.]—*Rev. Vet. e Zootechnia*, 1918. Vol. 9. No. 1. pp. 3–15. With 6 text figs.

Yorke (Warrington) & Macfie (J. W. S.). Strongylidae in Horses. iv *Gyalocephalus capitatus*, *Loos*. v *G. equi*, *sp. n.*—*Ann. Trop. Med. & Parasit.*, 1918. July. Vol. 12. No. 1. pp. 79–92. With 12 text figs.

MYCOTIC DISEASES.

Capmau. Quelques observations sur la lymphangite épizootique. Méthode Velu et méthode Belin. [Some Observations on the Treatment of Epizootic Lymphangitis by Velu's and Belin's Methods.]—*Bull. Soc. Cent. Méd. Vét.*, 1918. June 20. *Rec. Méd. Vét.*, 1918. Aug. 30. Sept. 30. Vol. 94. Nos. 16 & 18. pp. 337–360.

Mori (Nello). Coltivazione del germe specifico de Farcino criptococcico. —Riproduzione sperimentale della malattia naturale nel cavallo. —Primi risultati di cura con un particolare prodotto specifico. [Cultivation of the Specific Organism of Epizootic Lymphangitis. Experimental Reproduction of the Natural Disease in the Horse. Preliminary Results in Treatment with a Particular Specific Product.]—*Clinica Vet.*, 1918. June 15–30. Vol. 41. Nos. 11–12. pp. 320–329.

Velu (H.). Quelques observations relatives à l'étiologie de la Lymphangite épizootique. [A few Observations regarding the Etiology of Epizootic Lymphangitis.]—*Bull. Soc. Path. Exot.*, 1918. May. Vol. 11. No. 5. pp. 351–357.

——. Les Variations leucocytaires dans le traitement de la Lymphangite Epizootique par la Pyothérapie polyvalente. [Variations in Numbers of Leucocytes in the course of Treatment of E.L. by means of Polyvalent Pyotherapy.]—*Ibid.* pp. 416–423. With 2 charts.

DISEASES DUE TO FILTERABLE VIRUSES.

Andrein (Alejamdro) & Badano (Carlos H.). La peste aviare (Pestis avium) nella Repubblica Argentina. [Fowl Plague in the Argentine Republic.]—*Nuovo Ercolani*, 1918. June 30. Vol. 23. No. 12. p. 158. (extract).

Berry (A. Holman). Some Remarks on Foot and Mouth Disease and other Diseases in relation to Differential Diagnosis.—*Vet. Record*, 1918. June 8. Vol. 30. No. 1,561. pp. 497–504.

The author deals concisely with the clinical manifestations in the following conditions.—(1) Catarrhal stomatitis, (2) petechial stomatitis, (3) papular stomatitis, (4) foot-and-mouth disease, (5) vesicular stomatitis, (6) pustular stomatitis, (7) ulcerative stomatitis, (8) necrosing stomatitis, (9) necrotic ulcers on tongue, (10) mycotic stomatitis or "dirty tongue" disease, (11) pseudomembranous stomatitis of sucklings, (12) spreading sores of lips, (13) Ranula or Frog tongue, (14) actinomycotic stomatitis, (15) pustular dermatitis.

Carpano (Matteo). Su di un virus filtrabile di probabile origine bovina. [A Filterable Virus Probably of Bovine Origin.]—*Clinica Vet.*, 1918. July 15. Vol. 41. No. 13. pp. 347–357.

Feers (A. G.). Infectious Anemia of Horses.—*American Jl. Vet. Med.*, 1918. Nov. Vol. 13. No. 11. pp. 527–533. With 10 text figs.

The author describes the clinical manifestations and some attempts at treat-

GUARNIERI (Giuseppe). Studi sul vaiuolo. [Studies on Variola.]—*Sperimentale,* 1918. Jan. 17. Vol. 72. No. 1–2. pp. 1–36. With 3 plates.

HEIZMANN. Vier Fälle von paralytischer Lumbago als Begleitsymptom von infektiöser Anämie der Pferde. [Four Cases of Paralytic Lumbago as an Accompanying Symptom in Equine Infectious Anaemia.]—*Berliner Tier. Woch.,* 1918. July 11. Vol. 34. No. 28. pp. 274–276.

LANFRANCHI (A.) & LENZI (F.). Sul pasaggio del virus rabido dalla madre al feto.—[Passage of Rabies Virus from Mother to Foetus.] —*Ann. d'Igiene,* 1918. May 31. Vol. 28. No. 5. pp. 233–237.

The substance of this article was extracted from another journal in the preceding number of this *Bulletin,* p. 185.

McARTHUR (Clifford L.). The Attenuation of Hog Cholera Virus and its Effect on Normal Hogs.—*Jl. Infect. Dis.,* 1918. June. Vol. 22. No. 6. pp. 541–558. With 3 text figs.

MARTIN (G.). Note sur la récolte du vaccin ensemencé sur génisse et sur les résultats obtenus avec le vaccin sec au Cameroun. [Method of Obtaining Vaccine from Inoculated Heifers and Results Obtained after Use of Dried Vaccine in the Cameroons].—*Bull. Soc. Path. Exot.,* 1918. July. Vol. 11. No. 7. pp. 593–594.

NUOVO ERCOLANI, 1918. Oct. 15–31. Vol. 23. Nos. 19–20. pp. 252–253.—La peste bovina in Italia. [Rinderpest in Italy.]

A small outbreak of rinderpest is stated to have occurred among cattle belonging to the civilian population just behind the fighting lines in Italy. It was soon eradicated by the prompt action of the authorities.

MORI (Nello). Afta epizootica in una mandra di bufalotti. Alcune considerazioni sulle origine del contagio. [Foot and Mouth Disease in a Herd of Buffaloes.]—*Clinica Vet.,* 1918. July 15. Vol. 41. No. 13. pp. 358–364.

PAUL (Gustav). Ueber Mischinfektionen auf der Kaninchenhornhaut bei der experimentellen Pockenepitheliose. [Mixed Infections on Rabbit Cornea in Experimental Variolar Keratitis.]—*Cent. f. Bakt.* 1. Abt. Orig., 1918. Jan. 31. Vol. 80. No. 6. pp. 361–370. With 17 text figs.

SCHEIBER. Beitrag zur Kenntnis der infektiösen Anämie. [Equine Infectious Anaemia.]—*Berliner Tier. Woch.,* 1918. July 11. Vol. 34. No. 28. pp. 271–274.

The author describes a number of cases of this disease among German horses on the Western Front in April 1918.

VELU. La variole des porcelets. [Variola of Young Pigs.]—*Rev. Gén. Méd. Vét.,* 1918. Apr. 15—May 15. Vol. 27. Nos. 316–317. pp. 136–145. With 4 text figs.

The substance of the above article has already been extracted in this *Bulletin* (1916. Vol. 4. No. 3. p. 115–117) from a series of articles that appeared in another journal.

WINCKEL (Ch. W. F.). Hondedolheid in Nederl.-Indië. [Rabies in Dutch East Indies.]—Koloniaal Instituut te Amsterdam. Mededeel. No. 11. Afdeel. Trop. Hyg. No. 6. pp. 45. 1918. Amsterdam: J. H. de Bussy.

BACTERIAL DISEASES.

Belin (M.). Des lymphangites contagieuses du cheval.—A : Nouvelle terminologie.—B : Contribution à l'étude du traitement par la pyothérapie. [Contagious Equine Lymphangites.—A : New Terminology.—B : Treatment by means of Pyotherapy.]—*Bull. Soc. Cent. Méd. Vét.*, 1918. May 2. *Rec. Méd. Vét.*, 1918. May 30. Vol. 94. No. 10. pp. 243–251.

Carpano (Matteo). Contributo alle conoscenze dell'infezione morvosa nei felini (*Felis leo, Felis tigris, Felis domestica*). Associazione *B. mallei*=*B. felisepticum*. [Studies on Glanders Infections in the Lion, Tiger, and Cat. Association of the Glanders Bacillus with *B. felisepticum*.]—*Ann. d'Igiene*, 1918. Feb. 28. Mar. 31. Apr. 30. Vol. 28. Nos. 2, 3, 4, pp 68–75 ; 138–148 ; 183–191. With 1 plate & 2 charts.

Duport (O.). Bacillo de Preisz-Nocard. [Bacillus of Preisz-Nocard.]—*Rev. Vet. e Zootechnia*, 1918. Vol. 9. No. 1. pp. 29–32.

Hines (A. J.). Notes on Treatment of Ulcerative Lymphangitis from Nov. 18, 1917 to Jan. 11, 1918.—*Vet. Jl.*, 1918. June. Vol. 74. No. 6. pp. 199–202.

Russ (Viktor K.) & Trawiński (Alfred). Ueber das Vorkommen von Bakterien der Coli-Typhusgruppe im Pferdemist. [The Presence of Bacteria of the Coli-Typhoid Group in Horse Dung.]—*Ztschr. f. Hyg. u Infektionskr.*, 1918. Feb. 1. Vol. 85. No. 1. pp. 33–102. With 18 text figs. & 30 tables.

Out of 1,000 samples of horse faeces examined 77 strains were cultivated which resembled *B. paratyphosus* B on the usual culture media. On more detailed study by sugar and agglutination tests they were found to differ widely among themselves and from all members of the so-called *B. paratyphosus* B. group.

van Saceghem (R.). Traitement de la Lymphangite ulcéreuse. [Treatment of Ulcerative Lymphangitis.]—*Bull. Soc. Path. Exot.*, 1918. Oct. Vol. 11. No. 8. pp. 683–685.

"Pyo- and leucocyto-therapy bring about recoveries but do not set up immunity against the disease. . . . Experiments are now in progress to test the value of vaccination with living bacteria from the lesions and it is hoped by this means to obtain immunisation against the affection."

Schreiber (O.) & Stickdorn (W.). Zur aktiven Immunisierung gegen die Geflügelcholera. [Active immunisation against Fowl Cholera.]—*Berliner Tier. Woch.*, 1918. Oct. 10. Vol. 34. No. 41. pp. 401–402.

Szász (Alfred). Schutz-und Heilimpfung der Schweine gegen Milzbrand. [Prophylactic and Curative Inoculation of Pigs against Anthrax.]—*Ztschr. f. Infektionskr. . . . . . d. Haustiere*, 1918. Sept. Vol. 19. No. 4. pp. 367–374.

——. Kann man die Rinder gegen Milzbrand und Rauschbrand gleichzeitig (simultan) impfen? [Can Cattle be Inoculated Simultaneously against Anthrax and Blackquarter.]—*Ztschr. f. Infektionskr. . . . . . d. Haustiere.*, 1918. Sept. Vol. 19. No. 4. pp. 375–383.

Thomas (M.). Contribution à l'étude des lymphangites ulcereuses par la pyothérapie. [Treatment of Ulcerative Lymphangitis by Pyotherapy.]—*Bull. Soc. Cent. Méd. Vét.*, 1918. June 20. *Rec. Méd. Vét.* 1918

TRAWIŃSKI (Alfred). Zur Morphologie und Biologie des *Bacillus suipestifer.* [Morphology and Biology of *B. suipestifer.*]—*Cent. f. Bakt.*, I. Abt. Orig., 1918. Jan. 31. Vol. 80. No. 6. pp. 339–349. With 1 text fig.

VELU. La septicémie contagieuse du porc au Maroc. [Contagious Septicaemia of the Pig in Morocco.]—*Rec. Méd. Vét.*, 1918. May 15. Vol. 94. No. 9. pp. 236–241.

The subject matter of this paper has already been extracted in this *Bulletin* (Vol. 6. No. 2. p. 126).

——. Au sujet des heureux effets de la pyothérapie non spécifique dans le traitement des lésions pyogènes. [The Good Results following Treatment of Suppurative Lesions by Non-Specific Pyotherapy.]—*Bull. Soc. Cent. Méd. Vét.*, 1918. June 20. *Rec. Méd. Vét.*, 1918. June 30. Vol. 94. No. 12. pp. 289–292.

MISCELLANEOUS.

ALDIGÉ (E.) The Symptomatology of Poisoning from Snake Bite in Cattle. —Abstracted in *Vet. Record.*, 1918. July 20. Vol. 31. No. 1567. p. 17.

——. L'amélioration des bovidés du Sénégal et les Sociétés de prévoyance indigène. [Improvement of Cattle Breeding in Senegal and Native Aid Societies.]—*Annuaire des Études historiques et scientifiques de l'Afrique occidentale francaise, 1917.* Abstracted in *Rev. Gén. Méd. Vet.*, 1918. Aug. 15. Vol. 27. No. 320. pp. 389-390.

ALGERIE. Rapport sur le fonctionnement de l'Institut Pasteur d'Algerie en 1917.—20 pp. 1918. Alger: E. Pfister.

HORNBY (H. E.). The Normal Erythrocyte Count of East African Native Cattle.—*Vet. Jl.*, 1918. July. Vol. 74. No. 7. pp. 243-244.

One bull, 9·7 millions; two cows, 7·8 to 10 millions; one ox, 9·6 millions; three young stock, 8 to 11·2 millions; five calves, 9·5 to 15 millions per cubic millimeter.

KOEVES (J.). Rauschbrand- und Bradsot-ähnliche Krankheit der Schweine. [Blackquarter and Bradsot-like Disease of Pigs.]—*Cent. f. Bakt.*, I. Abt. Orig, 1917. Aug. 30. Vol. 80. No. 1/3. pp. 40–65. With 5 plates.

MASSINI (P. C.). Instituto Biológico de la Sociedad Rural Argentina. Resúmen de los Trabajos efectuados durante el Año 1917. [Summary of the Work done in 1917 at the Biological Institute of the Rural Society of Argentina.]—*Anales Soc. Rural Argentina*, 1918. Mar. Vol. 52. No. 3. pp. 141–147.

"In the report of the Parasitological Section, it is stated that a complete anatomical and histological study has been made of ticks in all stages of development and that this is being used as a basis for the experiments now being conducted with cattle and equines."—*Rev. App. Entom.*, Ser. B, 1918. Sept. Vol. 6. Part 9. p. 180.

MOUQUET. Autopsie d'hippopotame. Considérations diverses. [Postmortem Examination of the Hippopotamus.]—*Bull. Soc. Cent. Méd. Vét.*, 1918. June 6. *Rec. Méd. Vét.*, 1918. June 30. Vol. 94. No. 12. pp. 266–272. With 2 text figs.

NEIVA (Arthur) & PENNA (Belisario). Viajem cientifica pelo Norte da Bahia, Sudoeste de Pernambuco, Sul do Piauhé e de Norte a Sul de Goiaz. [A Scientific Journey through the North of Bahia, South-east of Pernambuco, South of Piauhy and from the North to the South of Goyaz.]—*Mem. Inst. Oswaldo Cruz.,* 1916. Vol. 8. No. 3. pp. 74–224. With 28 plates & 1 map.

OSBORNE (Thomas B.) & MENDEL (Lafayette B.). The Food Value of Soy Bean Products.—*Proc. Soc. Experim. Biol. & Med.,* 1917. May 16. Vol. 14. No. 8. pp. 174–175.

PÉRUSSET. Contribution à l'étude de l'agalactie contagieuse des chèvres et des moutons. [Contagious Agalaxy of Goats and Sheep.]—*Schweizer Arch. f. Tierheilk.,* 1918. Sept. Vol. 60. No. 9. pp. 403–412. With 12 text figs.

ROSSAS (José Francisco). Contribuiçao para o estudo da epizootia reinante no Estado do Espirito Santo. [Study of an Outbreak in the State of Espirito Santo, Brazil.]—*Rev. Vet. e. Zootechnia,* 1917. Vol. 8. No. 2. pp. 46–48.

SANFELICE (Francesco). Recherches sur la genèse des corpuscles du Molluscum contagiosum. [Researches on the Origin of the Corpuscles in Molluscum contagium.]—*Ann. Inst. Pasteur* 1918. Aug. Vol. 32. No. 8. pp. 363–373. With 1 coloured plate comprising 18 figs.

SCHMIEDHOFFER (Julius). Zur Ätiologie der Schweinediphtherie. [Etiology of Swine Diphtheria.]—*Ztschr. f. Infektionskr. . . . . . d. Haustiere.* 1918. Sept. Vol. 19. No. 4. pp. 345–366. With 3 text figs.

SELLARDS (Andrew Watson) & BAETJER (Walter Albert). The Clinical Significance of the Irregular Distribution of Various Cells and Parasites in the Blood Stream and the Production of Abortive Leukaemic Changes and of Splenomegaly in the *Macacus rhesus.*—*Johns Hopkins Hosp. Bull.,* 1918. June. Vol. 29. No. 328. pp. 134–141. With 1 plate.

DE VASCONCELLOS (Aleixo). Nova materia corante para substituir a solução de Giemsa (Azurol). [New Giemsa substitute (Azurol).]—*Rev. Vet. e Zootechnia,* 1917. Vol. 8. No. 2. pp. 42–45.

WYSSMANN (E.). Weitere Mitteilungen über die Atoxyltherapie des bösartigen Katarrhalfiebers. [Further Reports on the Atoxyl Treatment of Malignant Catarrhal Fever.]—*Schweizer Arch. f. Tierheilk.,* 1918. May. Vol. 60. No. 5. pp. 189–215.

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